



U.S. Department of Energy

Office of River Protection

P.O. Box 450
Richland, Washington 99352

SEP 09 2004

04-ESQ-074

Mr. E. S. Aromi, President
and General Manager
CH2M HILL Hanford Group, Inc.
Richland, Washington 99352

Dear Mr. Aromi:

**CONTRACT NO. DE-AC27-99RL14047 – REQUEST FOR ACTION ON ASSESSMENT OF
INSTRUMENT AND CONTROL (I&C) COMPUTER SOFTWARE**

This letter forwards the results of the U.S. Department of Energy, Office of River Protection assessment of CH2M HILL Hanford Group, Inc. (CH2M HILL), control of I&C computer software in the Hanford Tank Farms during the period of August 2 – 6, 2004. The assessment team identified two Findings and made seven Observations. The details of the assessment, including the Findings and Observations, are documented in the assessment report (attachment).

The assessment team found CH2M HILL had made considerable progress in improving its processes for the control of I&C computer software. For example, new procedures and a company standard were implemented to clearly define the processes for the control of I&C software. However, the administrative process for controlling the validation testing of I&C software requires correction. Also, the software change process employed by Fluor Government Group during development of software for the Tank Farms monitoring and control system and the master pump shutdown system were not always followed.

Within 30 days of receipt of this letter, CH2M HILL should respond to the Findings of the assessment. The response should include:

- Admission or denial of the Finding;
- The causes of the Findings if admitted, and, if denied, the reason why;
- The corrective steps that have been taken and the results achieved;
- The corrective steps that will be taken to prevent further Findings; and
- The date when full compliance with the applicable commitments in your quality assurance program will be achieved.

Mr. E. S. Aromi
04-ESQ-074

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The Observations do not identify any deficiencies, but represent experience-based Observations of the team members that CH2M HILL should consider as a source of information for improving their program. In addition to responding to the Findings, CH2M HILL should state the actions it intends to take as a result of the Observations.

If you have any questions, please contact me, or your staff may call Robert C. Barr, Director, Office of Environmental Safety and Quality, (509) 376-7851.

Sincerely,

A handwritten signature in cursive script that reads "Robert C. Barr for".

Roy J. Schepens
Manager

ESQ:DHB

Attachment

U.S. DEPARTMENT OF ENERGY
Office of River Protection
Environmental Safety and Quality

ASSESSMENT: Control of Tank Farms Instrumentation and Control Computer Software

REPORT: A-04-ESQ-TANKFARM-011

FACILITY: CH2M HILL Hanford Group, Inc.

LOCATION: Richland, Washington

DATES: August 2-6, 2004

ASSESSORS: David H. Brown, DOE-ORP, Lead Assessor
Shivaji S. Seth, DOE-RL Assessor
Clifford A. Ashley, DOE-RL, Assessor

APPROVED BY: P. P. Carier, Verification and Confirmation Official

Executive Summary

Introduction

From August 2-6, 2004, the U.S. Department of Energy (DOE), Office of River Protection (ORP) assessed the implementation of the Tank Farm contractor's program for controlling instrumentation and control (I&C) computer software. The contractor for the operation and maintenance of the Hanford Tank Farms is CH2M HILL Hanford Group, Inc. (CH2M HILL). The assessment team (Team) evaluated the control of safety software used in the instrumentation and control of safety systems, structures, and components. The Team used criteria, review, and approach documents provided by the DOE Office of Assistant Secretary for Environmental Safety and Health to guide its review of the following areas:

- Validation and Verification;
- Software Design Descriptions;
- Software Requirements Descriptions;
- User Documentation;
- Software Quality Assurance;
- Software Procurement;
- Software Problem Reporting and Corrective Actions; and
- Software Configuration Management.

The assessment team included the following I&C systems in its assessment:

- Tank Farms monitoring and controls system (M&CS), including the master pump shutdown system (MPSS);
- AN Tank Farm primary ventilation instrumentation and control equipment;
- AY/AZ Tank Farms ventilation system monitoring and control equipment;
- SY B-Train exhauster monitoring and control equipment; and
- 242-A Evaporator monitoring and control system.

The M&CS, the MPSS, and the AN Tank Farm primary ventilation system were all in late stages of development by Fluor Government Group, Inc. (FGG), a subcontractor to CH2M HILL. The remaining systems were existing and of varying ages.

Significant Conclusions and Issues

- The Team found CH2M HILL was continuing to improve their processes for the control of computer software. A recent ORP assessment of design and analysis software identified problems in CH2M HILL's implementation of software quality assurance requirements, and these were still being resolved. The current assessment did not identify any new programmatic issues.
- Some CH2M HILL validation testing following maintenance did not provide all documentation required by procedures, and procedures did not define the whole maintenance testing process. (This was an assessment Finding.)
- FGG software change request documents for the M&CS and MPSS development projects were not always controlled in accordance with the process described in the project quality assurance and configuration management plans. (This was an assessment Finding.)

In addition to the Findings, the Team identified several issues that are classified as Observations. Observations are issues based on opinions of the Team rather than contractual noncompliances. ORP may request a response from the contractor on Observations. The Observations addressed the following issues:

- CH2M HILL Engineering had a very small cadre of people trained to develop and maintain software for programmable logic controllers (PLC), particularly Allen-Bradley PLCs. PLCs were playing an increasingly critical role in Tank Farms operations. The assessment team concluded CH2M HILL should enhance the training of existing personnel responsible for PLCs and increase the number of personnel with the necessary skills for changing and testing PLC software;
- FGG's contract with CH2M HILL for development of the M&CS and MPSS software required them to follow CH2M HILL software engineering procedures, but they did not do this. Instead, they followed a reasonable set of processes described in the project quality assurance plan and configuration management plan. The assessment team reviewed the actual work done and concluded these irregularities did not create any questions about the adequacy of the software. However, the assessment team also concluded CH2M HILL should require subcontractors like FGG to develop and follow their own software engineering procedures;
- The technical depth of FGG assessments of software development activities could be improved. While independent surveillance assessments performed by FGG could identify compliance issues, they lacked the technical depth to identify complex process breakdowns;
- The control system software documentation located in the 242-A Evaporator control room was outdated. CH2M HILL should replace it with documentation applicable to the version release installed in the evaporator monitoring and control system control modules;

- CH2M HILL procedures should provide explicit controls for “software forces.” “Software forces” are temporary configurations in control systems that simulate plant conditions. They are required to be controlled like any other temporary modification or temporary bypass; and
- CH2M HILL should have a process for promptly reconciling new safety requirements with ongoing projects. CH2M HILL and FGG were waiting for the operations acceptance testing and accompanying unreviewed safety question processes before comparing documented safety analysis requirements to the M&CS project requirements. The assessment team considers this introduces unnecessary risk from late identification of requirements.

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List of Acronyms

CD	Compact Disc
CH2M HILL	CH2M HILL Hanford Group, Inc.
CFR	Code of Federal Regulations
COTS	Commercial-Off-the-Shelf
CRAD	Criteria, Review, and Approach Document
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
FGG	Fluor Government Group, Inc.
HMI	Human-Machine Interface
I&C	Instrumentation and Control
M&CS	Monitoring and Control System
Micon	Micon-Powell Process Systems, Inc.
MPSS	Master Pump Shutdown System
NovaTech	NovaTech Process Solutions, LLC
NQA-1	ASME NQA-1-1989, <i>Quality Assurance Program Requirements for Nuclear Facilities</i>
ORP	U.S. Department of Energy, Office of River Protection
PCS	Process Control System
PDS	Project Development Specification
PER	Problem Evaluation Request
PLC	Programmable Logic Controller
QA	Quality Assurance
QAP	Quality Assurance Program
QAPD	CH2M HILL Quality Assurance Program Description
SCADA	Supervisory Control and Data Acquisition
SCM	Software Configuration Management
SCR	Software Change Request
SDD	Software Design Description
SQA	Software Quality Assurance
SQAP	Software Quality Assurance Plan
SRD	Software Requirements Description
SRS	System Requirements Specification
V&V	Verification and Validation
WFO	Waste Feed Operations

Control of Tank Farms Contractor Instrumentation and Control (I&C) Software for the Period of August 2 - 6, 2004

Assessment Purpose and Scope

The assessment team compared the contractor's processes for the control of I&C software to the criteria specified in U.S. Department of Energy, Office of Assistant Secretary for Environmental Safety and Health Criteria, Review, and Approach Document (CRAD) 4.2.3.1, Revision 3, "Criteria and Guidelines for the Assessment of Safety System Software and Firmware at Defense Nuclear Facilities" and the Contractor's Quality Assurance Program Description (QAPD)¹. The CRAD was prepared in response to Defense Nuclear Facilities Safety Board recommendation 2002-1, "Quality Assurance for Safety Software at Department of Energy Defense Nuclear Facilities."

Significant Observations and Conclusions

The Contractor documented its quality assurance program in TFC-PLN-02, Revision A-3, "Quality Assurance Program Description." The QAPD stated that its requirements were based on American Society of Mechanical Engineers NQA-1-1989, "Quality Assurance Program Requirements for Nuclear Facilities" (NQA-1). While the QAPD addressed computer software, it drew its explicit software control requirements from NQA-1, Supplement 3S-1, "Supplementary Requirements for Design Control," and Supplement 11S-2, "Supplementary Requirements for Computer Program Testing." As discussed in the U.S. Department of Energy, Office of River Protection (ORP) assessment A-04-ESQ-TANKFARM-006, CH2M HILL did not explicitly invoke the requirements of Subpart 2.7, "Quality Assurance Requirements for Computer Software for Nuclear Facility Applications."

Systems Evaluated:

The assessment team reviewed documentation and interviewed responsible personnel for the following I&C systems:

- Tank Farms monitoring and controls system (M&CS), including the master pump shutdown system (MPSS);
- AN Tank Farm primary ventilation instrumentation and control equipment;
- AY/AZ Tank Farms ventilation system monitoring and control equipment;
- SY B-Train exhaustor monitoring and control equipment; and

¹ TFC-PLN-02, Revision A-3, *Quality Assurance Program Description*

- 242-A Evaporator monitoring and control system.

Tank Farms M&CS – At the time of the assessment fieldwork, the M&CS was in a late stage of development and deployment. It was a supervisory control and data acquisition system (referred to as a “SCADA system”) intended to automate many Tank Farms operations. In particular, the MPSS component would provide waste transfer routing information, including indication of many valve positions. Transfer pumps were controlled by the system. The MPSS safety function was to automatically shut down transfer pumps and terminate transfers on a signal from any leak detector or signals indicating system configuration anomalies. While there was no control room for the M&CS, human-machine interfaces (HMI) were located at seven nodes. Waste transfers could be planned, initiated, and shut down from any of these HMIs.

The system used programmable logic controllers (PLC) manufactured by RTP Corporation. These were Institute of Electrical and Electronics Engineers class 1E components, designed and sold as nuclear-grade equipment. The M&CS system was designed and assembled by Fluor Government Group Inc. (FGG), and was scheduled for turnover to CH2M HILL in February 2005. At that time, FGG was to have completed all “factory acceptance tests” and CH2M HILL was to begin “operations acceptance tests.”

The software used in the system was Citect (configurable commercial firmware provided by RTP Corp.), NetArrays (commercial communication and HMI software), and custom logic developed by FGG. Development and testing of the logic was a significant effort of the project. FGG performed development work in their Richland office and tested software on the PLCs while they were in Richland. FGG referred to testing in Richland as “qualification testing.” When qualification testing was complete, the PLCs were installed onsite. However, FGG maintained a test bed in Richland where software changes and upgrades were initially tested. Tested software was then copied from the test bed PLCs and uploaded onto the field PLCs.

At the time of the assessment fieldwork the logic developed in Richland had been accepted by FGG, but some configuration changes were continuing. Although field acceptance tests were complete, FGG had scheduled a final round of acceptance tests to address late configuration changes.

AN Tank Farm Ventilation Equipment – The AN Tank Farm ventilation equipment was another system that was being incorporated into the M&CS. Like MPSS, it used RTP Corporation PLCs along with NetArrays, Citect, and locally configured software. The logic and system configuration were developed by the same individuals in FGG who developed the MPSS software. At the time of the assessment fieldwork, FGG and CH2M HILL anticipated that turnover to CH2M HILL would occur in September 2004. Following turnover, CH2M HILL would conduct operations acceptance testing.

The Tank Farms documented safety analysis (DSA) assumed continuous ventilation through the AN Tank Farm. Therefore, there was a technical safety requirement specifying that the AN ventilation system was operating. If the system was not operating, no activities with the potential to ignite flammable gases were allowed. The safety function of the M&CS for the AN Tank Farm would indicate to operators that the ventilation system was operating.

AY/AZ Tank Farms Ventilation System – The AY/AZ Tank Farms ventilation system was based on a M&CS provided by Micon-Powell Process Systems, Inc., (Micon). The system was originally purchased in the late 1980's for a project that was cancelled before the equipment was installed. The equipment was removed from storage and incorporated into the AY/AZ ventilation system when it was built in the mid 1990's. Because the AY and AZ Tank Farms had high decay heat loads, an important function of the system was to provide cooling for the tanks. However, the only safety function with respect to the DSA was to provide indication that the ventilation system was running (and therefore removing flammable gases). The system controlled ventilation fans and monitored a number of system parameters such as temperatures, radiation levels, and valve positions.

CH2M HILL personnel said that Micon was no longer able to fully support all of its customers, and they were afraid that some key support would become unavailable in the future. Therefore, they planned to replace the monitoring and control equipment with a new system using equipment similar to that used in the Tank Farms M&CS.

SY B-Train Exhauster Monitoring and Control Equipment – The SY B-Train system used a single PLC manufactured by Allen-Bradley, a subsidiary of Rockwell Automation. It was one of a pair of filtered ventilation trains used to remove flammable gases from the SY Tank Farm head spaces. (The SY-A ventilation train was not regulated by digital controllers.) The equipment was mounted on a skid that was built in the mid-1990s. Programming access and indication for the PLC were provided by an Allen-Bradley HMI, and custom software developed for the equipment used Allen-Bradley ladder logic. The safety function of the system would provide indication to operators that the ventilation system was operating to remove flammable gasses from the SY tanks.

242-A Evaporator M&CS -- The Evaporator facility monitoring and control equipment was a relatively complex patchwork of systems. While the equipment was intended for operating the Evaporator, it also had the capability of monitoring some transfer leak detectors in the Tank Farms. The only safety function of the systems was to indicate leakage reported by the Tank Farms leak detectors during transfers. However, the new Tank Farms M&CS system was to take over monitoring these leak detectors in the coming months. At that time the equipment at the Evaporator would no longer have a safety function.

Functions specific to the Tank Farms were handled by a control module using software named D/3® running on a Digital Equipment Corp. platform. D/3 was supported by NovaTech Process Solutions, LLC, (NovaTech). In the early 1990s, when the control module was originally delivered, the business unit that manufactured it was owned by Texas Instruments. While the equipment was old, CH2M HILL personnel said NovaTech continued to provide adequate support to CH2M HILL. (A NovaTech motto was, "No D/3 left behind.")

CH2M HILL took over control of the Evaporator from Fluor Hanford, Inc., on May 26, 2003.

Assessment Team Conclusions:

Software Requirements Descriptions (SRD)

The assessment criteria were fully satisfied. The functional and performance requirements for the I&C software were complete, correct, consistent, clear, testable, and feasible. Also, software requirements were documented and consistent with the system safety basis (except as discussed below). SRDs were controlled and maintained. Requirements were identified and defined such that they could be verified and validated.

When the Tank Farms DSA was approved, there was no mechanism for a prompt reconciliation of new requirements with the existing MPSS and M&CS requirements. Instead, CH2M HILL anticipated that the unreviewed safety question process at project turnover would assure that all DSA requirements were satisfied. However, the assessment team was concerned that this approach could provide very late identification of inconsistencies resulting in project delays. Delays place pressure on personnel to cut corners on quality. (Assessment Observation A-04-ESQ-TANKFARM-011-O05.)

Except for MPSS and M&CS, all software applications reviewed had a distinct SRD that included a well-defined functional requirements basis at the system level. Considering the nature of the applications involving PLC's and HMI, where the software requirements, design, and implementation life-cycle phases can often be integrated, the SRD along with the software design descriptions (SDD) provided adequate requirements description. In the case of the MPSS and M&CS, the assessors found that the Project Development Specification (PDS) and the SDD generally satisfied the need for software requirements definition and description. However, they also believed that the development of an appropriate software requirements specifications document (e.g., by applying a consensus standard such as IEC-880 or IEEE-830) would have provided greater traceability between system functional requirements and software design implementation, and thereby a greater assurance of reliability. (Assessment Observation A-04-ESQ-TANKFARM-011-O06.)

SDDs

The software applications had generally adequate design descriptions consistent with the nature of PLC and HMI applications. The CRAD assessment criteria were met. I&C software-related requirements are implemented in designs, and design elements were traceable to the requirements. Designs were correct, consistent, clearly presented, and feasible.

User Documentation

The criteria of the CRAD were met. User's manuals contained appropriate documentation for their equipment. Documentation provided information to aid the users in the correct operation of the software and to provide assistance for error conditions. Manuals reviewed by the assessors provided adequate guidance on software design and coding requirements.

The control room user's manuals for the D/3 equipment in the 242-A Evaporator were not current. The current documentation was on a compact disc (CD) kept by the system engineer. The assessment team concluded CH2M HILL should print out the documentation from the CD and use it to replace outdated user documentation in the 242A Evaporator control room. (Assessment Observation A-04-ESQ-TANKFARM-011-O02.)

While CH2M HILL has provided appropriate training on most equipment, it has not provided training for personnel maintaining Allen-Bradley PLCs. Also, the number of individuals trained to maintain I&C software was very small. (Assessment Observation A-04-ESQ-TANKFARM-011-O01.)

Software Verification and Validation (V&V)

The CRAD assessment criteria were partially satisfied. CH2M HILL and FGG were verifying software requirements and validating software designs for correct operation. They were also evaluating relevant abnormal conditions for mitigating unintended functions.

However, the assessment team found that CH2M HILL's new key procedure governing control of I&C software referenced invalid procedures for making and testing software changes. Also, the Waste Feed Operations (WFO) Software Quality Assurance Plan (SQAP), and the WFO Software Configuration Management Plan (SCMP) lacked sufficient criteria to consistently test changes to I&C software. (Assessment Finding A-04-ESQ-TANKFARM-011-F01.)

Software Configuration Management

The CRAD assessment criteria were partially satisfied. The assessment team found that CH2M HILL had adequately identified their software components and products, and procedures existed to manage the modification and installation of new versions. However the assessors also found that software change request documentation and temporary modifications to I&C software were not always completed in accordance to plans or procedures. (Assessment Finding A-04-ESQ-TANKFARM-011-F02.)

Software Quality Assurance

The CRAD assessment criteria were generally met. CH2M HILL had significantly improved its Software Quality Assurance (SQA) processes since Defense Nuclear Facilities Safety Board Tech-25 was issued. ORP identified some continuing issues in assessment A-04-ESQ-TANKFARM-006, "Control of Tank Farms Contractor Design and Analysis Computer Software," but CH2M HILL and FGG were resolving them.

CH2M HILL had recently issued a new I&C software engineering procedure and a new I&C software standard. The assessment team found both generally included appropriate guidance and direction. However, the new procedure did not correctly identify procedures for testing software changes made during maintenance. (Assessment Finding A-04-ESQ-TANKFARM-011-F01.) CH2M HILL Waste Feed Engineering had also issued a new SQA plan intended to address I&C

safety software. CH2M HILL was in the process of extending its scope to address safety systems.

In Assessment Report A-04-ESQ-TANKFARM-006, ORP identified deficiencies in the CH2M HILL assessment program with respect to SQA. At the time of the current assessment, ORP and CH2M HILL had not finished closing this issue.

FGG was not explicitly following CH2M HILL software engineering procedures for MPSS development work as specified in the contract between CH2M HILL and FGG. Instead, FGG personnel were following relatively detailed requirements in the MPSS SQA/configuration management plan. Both the SQA/configuration management plan and the CH2M HILL procedures described appropriate software engineering processes, but they were not the same. Therefore, while FGG was not complying with its contractual obligations to CH2M HILL, the assessment team did not identify any resulting problems with the software FGG was developing. The assessment team concluded CH2M HILL should require subcontractors to develop and follow their own implementing procedures. (Assessment Observation A-04-ESQ-TANKFARM-011-O04.)

FGG performed independent surveillance-level assessments of MPSS and M&CS software development activities, but these lacked technical depth. While surveillances could identify compliance issues, they lacked the technical depth to identify more complex process breakdowns. For example, the answers to questions on a surveillance checklist reflected a superficial understanding on the part of the surveillance engineer of the relative roles of different software components. (Assessment Observation A-04-ESQ-TANKFARM-011-O03.)

Software Procurements

The criteria were met for current procurements. CH2M HILL did not have objective evidence that procurements made in the mid-1990s conformed to all requirements, but this problem was identified and resolved previously.

ORP evaluated FGG's software procurements for the Tank Farms M&CS and MPSS in an earlier assessment and found them to be appropriate.

Software Problem Reporting and Corrective Action

While the criteria for problem reporting and corrective action were met, multiple processes existed for different software development and maintenance activities. These were specified in individual quality assurance plans. CH2M HILL said they were in the process of establishing a single, company-wide procedure for software error reporting.

Software errors were reported and resolved using the established systems, both in CH2M HILL and FGG. Some issues with error resolutions are addressed in the configuration management section of this report.

List of Items Opened, Closed, and Discussed

Opened

A-04-ESQ-TANKFARM-011-F01: CH2M HILL plans and procedures did not accurately define the processes for identification and execution of software maintenance and testing.

Requirements:

TFC-PLN-02, Revision A-3, "Quality Assurance Program Description," Section 2.5.2.1 "General Requirements for Work Processes," stated: "All activities that can affect the quality, safety, or the environment of CH2M HILL products and services shall be prescribed by, and performed, in accordance with documented, management-approved procedures, instructions, and design documents that meet the requirements of applicable regulatory requirements, DOE orders, technical standards, and administrative controls."

Discussion:

CH2M HILL was in the process of making extensive improvements in the requirements infrastructure for software engineering, including generation of new procedures and plans. The assessment team reviewed many of these new procedures and plans, and found they were appropriate improvements to CH2M HILL's processes. However, the assessment team found some documents that either contained errors or did not specify the required level of rigor for safety software. The assessment team based its conclusions on the following:

- The key procedure governing maintenance of I&C software did not specify the correct process for testing some changes to I&C software made during maintenance activities. CH2M HILL made procedure TFC-ENG-DESIGN-P-12, Revision A, "Process Control Software Procedure" effective on April 2, 2004, to describe the overall process for developing, documenting, testing, control, and maintenance of I&C software. Despite a statement in the "Purpose and Scope" section of the procedure to include maintenance, there was no section specific to maintenance. Procedure Section 4.6, "Modification of Implemented Software," addressed most software maintenance activities. For testing of completed changes, this section required testing to be conducted in accordance with several testing procedures, including TFC-PRJ-SUT-C-01, "Test Plan Preparation," and TFC-ENG-DESIGN-C-18, "Testing Practices." However, these procedures, along with the other procedures invoked by Section 4.6, contained scope statements that explicitly excluded testing of maintenance work. In this context, "maintenance" would not include software many changes and upgrades, therefore the personnel preparing work packages could be expected to navigate the system successfully. However, there was no procedure to address testing of corrective maintenance required to bring the software into conformance with the system design;
- CH2M HILL WFO SQAP (RPP-2108, Revision 0), Section 4.13 stated: "Testing is performed as described in the WFO SCMP on a case-by-case basis depending upon the magnitude of the changes being made." Neither the SCMP (RPP-21082, Revision 0) nor the

WFO SQAP identified who in CH2M HILL would determine the “magnitude of the change,” nor did they provide criteria for a graded approach to V&V testing; and

- The WFO SCMP lacked criteria for initiating a software change request (SCR), although it discussed the SCR process in Section 3.1.10.

A-04-ESQ-TANKFARM-011-F02: SCR documentation was not adequately maintained.

Requirement:

1. RPP-6764, Revision 0, “Master Pump Shutdown MPS Software Quality Assurance Plan,” Section 8, contained instructions for preparing the SCR or Problem Report (PR) form, which stated that the Lead Engineer, “Track information by entering into the SCR database, evaluate SCR/PR or group of SCR/PRs against Appendix A of this SQAP. Check when complete, and ensure activities are completed.” Also, the SQAP Appendix A, for Design activity, and Configuration Management activity, stated that the SCR/PR is to be used by the MPSS PE to “Ensure that the SCR/PR(s) effects and enhancements are documented in Programmer’s/Design Document” and, “Track all system problem reports or change requests.”
2. RPP-21082, Revision 0, “Software Configuration Management Plan for Waste Feed Operations (WFO) Process Control Systems (PCS),” Chapter 4, first paragraph stated: “Software release modifications will be certified in a test environment where possible. During development, tests are informal (precursor) up to the qualification test. Afterwards, more normal testing methods shall be utilized as applicable to test the system. This includes a testing evaluation for each Software Change Request (SCR).”

Discussion:

The assessors found that several software change requests were not adequately maintained, as evidenced by the following examples. It should be noted that the majority of the issues identified were associated with the FGG MPSS development work. Although the MPSS qualification test report (RPP-9614) stated: “open SCR’s would be handled by the MPSS SQAP release process,” this process was neither timely nor effective.

- CH2M HILL could not locate the most recent SCR for the SY B-Train exhaustor when requested by the assessment team. CH2M HILL management determined the document was lost;
- Sixteen SCRs initiated by FGG for the MPSS (SCR # 711, 714, 716, 722, 723, 726, and 731 through 740) that were initiated prior to August 2002 (during the MPSS qualification testing) were not closed until after January 2004. The closure of these SCRs occurred well after the acceptance test was completed and the test report (RPP-12520) was issued. The assessment team reviewed these SCRs and concluded that the majority of the SCRs involved enough complexity they could have adversely affected the acceptance testing if they were not

effectively closed prior to this testing;

- Ten SCRs initiated by FGG for the MPSS (SCRs # 715, 717 through 720, 724, and 727 through 730) were documented as being “closed” without any “closed by” signature or date in the SCR status record, or on the “MPSS System and Software Change Request and Problem Report Form” documents;
- Sixteen SCRs initiated by FGG for the MPSS (SCR # 678, 707, 708, 711, 714, 717 through 720, 722 through 724, 726, 732, 737, and 740) were documented as being “closed” without any “verified by” signature or date in the FGG SCR status record, or on the “MPSS System and Software Change Request and Problem Report Form” documents;
- Ten SCRs initiated by FGG for the MPSS (SCR #587, 668, 678, 706 through 712) were documented as being “closed” on the FGG SCR status record, but did not have the “verified by” and/or “closed by” signature and date information that appeared on the on the original hard copy “MPSS System and Software Change Request and Problem Report Form;”
- One SCR initiated by FGG for the MPSS (#710) that was documented as being “closed” on FGG’s SCR status record, had “closed by” signature and date information that was significantly different then the original hard copy “MPSS System and software change Request and Problem Report Form;”
- One SCR initiated by FGG for the MPSS (#730) that was documented as being “closed” on FGG’s SCR status record had a “verified by” signature and date (September 25, 2002) that did not appear on the original hard copy “MPSS System and Software Change Request and Problem Report Form.”

A-04-ESQ-TANKFARM-011-O01 – Engineering should provide additional training and train additional personnel for developing and maintaining software for programmable logic controllers.

Discussion:

While CH2M HILL provided software training for some personnel performing system engineer functions, it had not provided formal training on Allen-Bradley PLCs. System engineers responsible for Allen-Bradley PLCs said they acquired their skill by studying user manuals. Also, the pool of CH2M HILL engineers who have received any training on PLCs at all was very small. Periodically, Engineering made changes to the logic and other configurable features in PLCs, and these changes must be independently verified by personnel with the necessary training and skill. While the assessment team did not find any problems caused by inadequate training of system engineers, it considers CH2M HILL should train a larger cadre of system engineers who can properly maintain PLCs. (The few engineers involved in maintaining digital I&C equipment other than Allen-Bradley PLCs did receive training on other equipment, usually from the vendor.)

A-04-ESQ-TANKFARM-011-O02 – The D/3 system documentation in the 242-A Evaporator should be replaced with documentation applicable to the release installed in the evaporator.

Discussion:

The user manuals for the D/3 process control modules in the 242-A Evaporator control room were outdated. The manuals were for Release 6.3 of the software when the equipment was actually running Release 9 software. Responsible CH2M HILL Engineering personnel said they had the correct version of the user manuals on CDs, and they would sometimes refer to the material on the CDs. However, the assessment team considered CH2M HILL should print out the Release 9 documentation, and use it to replace the outdated manuals that were in the control room.

A-04-ESQ-TANKFARM-011-O03 – The technical depth of FGG assessments of software development activities can be improved.

Discussion:

FGG performed surveillance-level assessments of the Tank Farms M&CS project, including the MPSS system, covering appropriate surveillance topics. These assessments, such as FGG surveillance QS2004-005, addressed straightforward compliance issues. However, the compliance assessments lacked the technical depth required to identify some kinds of process breakdown. The assessment team considers FGG should be performing assessments capable of identifying more complex issues. These assessments would require greater technical insight on the part of individuals performing the assessments.

A-04-ESQ-TANKFARM-011-O04 – In implementing quality assurance requirements, CH2M HILL should require contractors to provide specific software engineering procedures.

Discussion:

For development of the MPSS as well as the monitoring and control system software, FGG developed relatively detailed quality assurance and configuration management plans. They did not develop procedures to implement the requirements of the plans, but simply managed compliance with plan requirements. FGG's contract with CH2M HILL did not stipulate that FGG was to develop project-specific procedures, but required instead that FGG personnel follow a specific set of CH2M HILL procedures. Because they were following the quality assurance and configuration management plans, FGG personnel did not explicitly follow the CH2M HILL procedures as required by their contract with CH2M HILL.

The assessment team did not identify any problems with the software arising from these inconsistencies. However, the Team concluded that it was inappropriate for CH2M HILL to specify that FGG personnel working in their own offices follow CH2M HILL procedures. Also, FGG should develop its own procedures implementing requirements specified in quality assurance and configuration management plans. These plans are intended to specify requirements, not provide process implementation steps.

A-04-ESQ-TANKFARM-011-O05 – CH2M HILL should consider providing a formal administrative mechanism that links the M&CS project development specification document to the authorization basis requirements.

Discussion:

CH2M HILL issued the new DSA during design and deployment of the MPSS and M&CS systems, but did not initially determine the effect of new DSA safety requirements. FGG and CH2M HILL were relying on the unreviewed safety question process and operational acceptance testing process to identify the affect of new requirements, but this would occur near the end of the project. The assessment team considers CH2M HILL should implement a process for identifying and implementing new and changed requirements in a timelier manner. Late identification of requirements introduces project risk, creating pressure to take quality shortcuts.

A-04-ESQ-TANKFARM-011-O06 – CH2M HILL should require its subcontractors to ensure that software requirements specifications are always specified and documented prior to commencing software design and implementation.

Discussion:

For the MPSS and M&CS systems, the assessors found that the PDS and the SDD generally satisfied the need for software requirements definition and description. However, they also considered that the development of an appropriate software requirements specifications document (e.g., by applying a consensus standard such as IEC-880 or IEEE-830) would have provided greater traceability between system functional requirements and software design implementation, and thereby a greater assurance of reliability.

A-04-ESQ-TANKFARM-011-O07 – Temporary modifications to I&C software (“software forces”) were not fully addressed in CH2M HILL procedures.

Discussion:

CH2M HILL procedure TFC-OPS-OPER-C-11, “Equipment Temporary Modifications and Bypasses,” provided an extensive and apparently exhaustive list of temporary modifications and temporary bypasses to plant systems and equipment. However, software forces were not explicitly listed, although they may qualify as either a temporary modification or a temporary bypass. Other procedures, such as those for startup and testing, also address temporary modifications and bypasses, but do not specifically address software forces. CH2M HILL problem evaluation requests (PER) PER-2004-0296 and PER-2004-0763, as well as surveillance CH-04-RPP-QSR-022, identified issues in which removal of software forces was overlooked by Maintenance, Test, Operations or Project personnel.

The assessment team considers CH2M HILL should re-evaluate all procedures addressing temporary modifications and bypasses and provide instructions explicitly addressing control of software forces.

Closed

None

Discussed

None

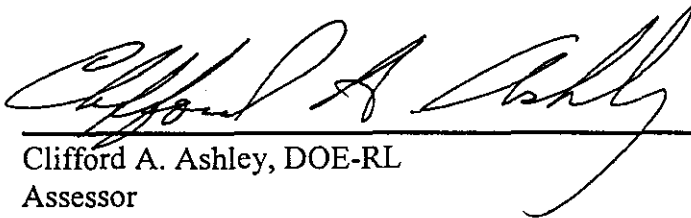
Signatures



David H. Brown, DOE-ORP
Assessment Team Leader



Dr. Shvaji S. Seth, DOE-RL
Assistant Assessment Team Leader



Clifford A. Ashley, DOE-RL
Assessor

Appendix A

Team Member Biographies

David H. Brown, Assessment Team Leader – Mr. Brown has been leading and participating in quality assurance assessments for 17 years. Several of these have included or been focused on computer software quality assurance. He has been certified as a Lead Auditor in accordance with the requirements of NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities*, since June, 1987. Mr. Brown holds a baccalaureate degree in nuclear science from the State University of New York, Maritime College (1971). He received formal training in computer software quality assurance from the Pacific Northwest National Laboratory in 1992. He participated in development of the following DOE directives and documents:

- The DOE response to DNFSB Recommendation 2002-1, *Quality Assurance for Safety Software at Department of Energy Defense Nuclear Facilities*.
- CRAD 4.2.3.1, *Criteria and Guidelines for the Assessment of Safety System Software and Firmware at Defense Nuclear Facilities*
- CRAD 4.2.4.1, *Assessment Criteria and Guidelines for Determining the Adequacy of Software Used in the Safety Analysis and Design of Defense Nuclear Facilities*
- DOE-STD-1172-2003, *Safety Software Quality Assurance Functional Area Qualification Standard*

Prior to coming to work for DOE, Mr. Brown served 14 years as a reactor plant test engineer for the U.S. Navy at Pearl Harbor Naval Shipyard.

Dr. Shivaji S. (Shiv) Seth, Assistant Assessment Team Leader – Dr. Seth is Senior Technical Advisor for Nuclear Safety at the DOE Richland Operations Office. He has reviewed the nuclear safety authorization basis and the operational safety of several nuclear facilities at the Hanford site, including those where safety software is deployed both in safety systems and in analyzing facility safety. As a member of a DOE team responding to DNFSB Recommendation 2002-1, Dr. Seth was a contributor to the development of the DOE qualification standard for software engineers and the CRADs for safety software assessments.

Prior to joining DOE in 1996, Dr. Seth managed and guided safety and systems engineering projects at the MITRE Corporation in support of the USNRC and DNFSB. He was the principal investigator of a major project for the USNRC for developing the guidelines, technical basis, and research needs for high-integrity (safety) software in nuclear power plant safety systems. This work (NUREG/CR-6263) has been cited as a resource in various USNRC Regulatory Guides.

Dr. Seth's 35 years of work in the nuclear field also includes nuclear reactor core design and analysis, optimization of the reactor fuel cycle, and safety and probabilistic risk analyses. These involved considerable programming and use of computers. His experience at a national laboratory includes planning and analyzing reactor critical experiments for investigating the design and safety of fast reactors and supervising reactor operations. These involved the use of digital instrumentation and control systems.

Dr. Seth holds Master's and Doctor's degrees in nuclear engineering from the Massachusetts Institute of Technology, Cambridge, Massachusetts, and has authored over 80 technical publications.

Clifford A. Ashley, Assessor – Mr. Ashley has been leading and participating in quality assurance assessments and surveillances during the last 13 years for the US DOE. This includes nine years experience as a DOE Facility Representative, as well as service as subject matter expert and various quality assurance positions with the New Production Reactor Project and the Tank Waste Remediation System Project. Several assessments included or were focused on computer software quality assurance.

During 1979 to 1981, Mr. Ashley's primary responsibility was to program a HP-1000 computer to record and extract critical test data from DOD sidewinder missile servomechanisms.

From February 2004 to August 2004 Mr. Ashley was a member of the DOE assessment team that evaluated the Bechtel National, Inc., design and analysis software, the Fluor Hanford, Inc., I&C and design & analysis software; as well as the CH2M HILL design and analysis software. He led the DOE assessment of the Pacific Northwest National Laboratory design and analysis software conducted in June 2004.

Mr. Ashley holds a baccalaureate degree in electrical engineering from Washington State University (1975), and a Master of Science degree in Electrical Engineering from North Dakota State University (1976).

Appendix B
Assessment Notes

Assessment Note

Assessment Note Number: A-04-ESQ-TANKFARM-011-01

Assessor Names(s): Shiv Seth

Dates of Assessment: August 2 – 11, 2004

Area/Item(s) Assessed: Software Requirements Description (SRD)

Objective: I&C software functions, requirements, and their bases are defined and documented.

Criteria:

1. The functional and performance requirements for the I&C software are complete, correct, consistent, clear, testable, and feasible.
2. The I&C software requirements are documented and consistent with the system safety basis.
3. The software requirements document (SRD) is controlled and maintained.
4. Each requirement should be uniquely identified and defined such that it can be objectively verified and validated.

Documents Reviewed:

- HNF-6780, Rev. 1, dated September 2003 – *Project Development Specification for Monitoring and Control System, Project W-314*
- RPP-6921, Rev. 1, dated June 2003 – *Project W-314, Master Pump Shutdown System (MPSS) Software Design Document*
- RPP-6819, Rev. 1, dated January 2003 – *Requirements Verification Report for MPSS*
- Excerpts from the current 2004 version of *Tank Farms Technical Specification Requirements*
- RPP-7011, dated October 2000 – *Gap Analysis of MPSS Design Requirements to Subsystem Specifications*
- RPP-12520, dated December 2003 – *Master Pump Shutdown System Acceptance Test Report*
- W-314-I-168, dated March 2003 – *Instrumentation Alarm Set Point Accuracy Calculation*
- W-314-I-187, dated November 2003 – *Tank Farms Restoration and Systems Operations MCS I/O List*
- HNF-6779, dated 2003 – *Project Development Specification for HVAC*
- RPP-12722, dated February 2003 – *Software Requirements Specification for HVAC*
- RPP-10291, dated February 2003 – *Software Design Plan for HVAC*
- RPP-12716, Rev. 0, dated February 2003 – *Software Verification and Validation Plan for HVAC*
- RPP-10668, dated September 2002 – *System Design Description for AY/AZ Tank*

- Farm Primary Ventilation System and Associated Cooling Water Systems*
- WHC-SD-WM-CSRS-025, dated April 1995 – *Computer Software Requirements and Specs for the AY/AZ Tank Farm Micon Automation System*
- WHC-SD-WM-SDP-010, dated April 1995 – *Software Development Plan for the AY/AZ Tank Farm Micon Automation System*
- HNF-SD-WM-CSWD-071, Rev. 3a, dated October 1998 – *Computer Software Configuration Description, 241-AY & 241-AZ Tank Farm Micon Automation System*
- RPP-15126, Rev. 1, dated October 2003 – *System Design Description for SY Tank Farm Primary Ventilation System (DSA-Based)*
- RPP-11159, Rev. 0, dated June 2002 – *Computer Software Description for 241-SY B-Train Exhauster*
- HNF-3395, Rev. 2, dated May 2003 – *Interface Control Document Between the 242-A Evaporator Facility and the Liquid Effluent Retention Facility*
- WHC-SD-534-SDP-001, Rev. 0, undated – *Process Control Computer Software Development Plan*
- WHC-SD-534-CSRS-001, Rev. 1, dated September 1993 – *Process Control Computer Software Requirements and Specifications*
- WHC-SD-534-CSWD-006, Rev. 2, dated April 1996 – *Continuous Control Databases for the 242-A MCS*
- WHC-SD-534-CSWD-005, Rev. 3, dated May 1996 – *Control System Device Logic Software Documentation*

Discussion:

The assessment team reviewed the system functional and software requirements specifications for the following systems, all of which basically involved programmable logic controller (PLC) and human-machine interface (HMI) applications:

- Master Pump Shutdown System (MPSS) / Monitoring and Control System (MCS)
- AN Ventilation System
- AY/AZ Ventilation System
- SY-B Exhauster System
- 242-A Evaporator

Software Developed by FGG – The software for the MCS, MPSS, and AN ventilation systems was being developed by the Fluor Government Group (FGG) under contract with CH2M Hill. For MPSS, there was no stand-alone document that provided the software requirements specifications. However, the Project Development Specification (PDS), HNF-6780, provided the system functional requirements based on a detailed system analysis, which could be traced to the software design document (RPP-6921). The latter document included descriptions of software component functions which had correspondence with the software functions described in the PDS. The verification of requirements was documented in the report, RPP-6819. The assessment team concluded FGG could have provided greater traceability and verifiability of software design implementation with respect to system functional requirements, and thereby a higher degree of software reliability, by developing a software requirements specification for the MCS and MPSS. The use of an appropriate procedure or a template based on CH2M

Hill's procedure (TFC-BSM-IRM_HS-C-03) or available consensus standards (e.g., IEC-880, IEEE-830) could have guided such development.

The assessment team focused its review on several specific software safety functions of the MPSS (e.g., leak detection alarm, detection response time limit, and master pump shut down as a result of leak detection) and traced those functional requirements from the safety authorization basis (AB) documents (e.g., Technical Specification Requirements) to their acceptance testing and to the plans for operational acceptance testing (OAT) prior to field implementation. The assessors interviewed the cognizant nuclear safety and licensing management and staff, as well as the manager responsible for the planned OAT. They also reviewed a few relevant calculation notes. The assessors were satisfied with the flow of the functional requirements through software requirements, design, and implementation. However, the assessors also noted that the absence of a functional requirements specification document specifically for the software reduced the level of traceability between system level requirements and software implementation, and thereby the degree of assurance of system reliability that could be associated with the software that was being developed. FGG could have achieved a higher level of assurance of system reliability through the use of an appropriate procedure or a template for preparing software requirements specifications based on available standards (e.g., ANSI/ISA-S88, IEEE-830).

The assessors also examined how the PDS, a key document for all system functional requirements, was kept current with respect to changes in AB and its implementation. CH2M Hill prepared a gap analysis nearly four years ago, which had identified gaps between the PDS and the subsystem specifications derived from AB. The AB was based on the final safety analysis report (FSAR) and not the current documented safety analysis (DSA). A second gap analysis was being developed at the time of this assessment. In addition, the assessment team was told that the Nuclear Safety and Licensing organization would confirm compliance of the MPSS to the current AB prior to OAT. They explained that any required changes to the PDS stemming from AB changes would be normally identified through the AB implementation process. The OAT itself would require evidence that all MPSS functions, including the software system functions, could be performed adequately. However, the OAT would not fully repeat the acceptance testing of the MPSS that was performed, but select the functions to be tested. Formal guidance for selecting the MPSS functions to be retested did not exist.

While it appeared that there was a generally adequate check on the MPSS conformance to AB requirements as part of the unreviewed safety question and OAT processes, the assessment team was concerned that there was not a formal process or mechanism in place that provided a clear link between the current DSA and the PDS such that any changes in AB would be automatically analyzed, and if applicable, reflected as changes in the PDS. Indeed, if such a system existed, the gap analyses that were being prepared would be redundant. Considering the extent of reliance of numerous major subsystems for their system functional requirements (including software and HMI) on the PDS, the assessment team believed that such a mechanism was needed to ensure that lower level software and other requirements always conformed to the authorization basis and other higher level requirements.

For AN ventilation, the system functional requirements were described in the primary PDS for MCS (HNF-6780) and the project development specification for the system (HNF-6769). The SRD (RPP-12722) for the system was derived from those documents as well as other appropriate system design documents, such as the project design concept for primary ventilation system. The assessors found that the key software functional requirements, including interlocks, alarms, and control features were well described. The V&V plan for the system (RPP-12716) explicitly called for the verification and validation of the software requirements from the functional and software requirements to the design and implementation life cycle phases.

AY/AZ Ventilation System – The I&C software controlling the ventilation for AY/AZ high level waste tanks was the Micon distributed control system. This was a legacy system that CH2M HILL planned to replace. Its safety function was to be integrated with the MCS that was under development as discussed above. The functional requirements were based on the system level design description (RPP-10668) and the software functions and design were described in the software requirements and configuration description documents, WHC-SD-WM-CSRS-025 and HNF-SD-WM-CSWD-071, respectively. The software for the Micon automation system was not programmed in the classical sense, being more of a “fill-in-the-blanks” approach using special configuration programs provided by Micon. However, the approach still required implementation conventions (relating to, for example, graphics, group displays, annunciators, discrete inputs and outputs, loop definition); and these appeared to be well described in the configuration description document. Also the requirements document provided the basis for set-points.

SY B-Train Ventilation Monitoring and Control Equipment – For the SY B-Train exhaust system, the I&C system consisting of a PLC manufactured by Allen-Bradley. The software comprised the PLC ladder logic software and MessageView® terminal software. The functional requirements of the software system were based on the system design description document (RPP-15126). The software functions and components of the software, including the control system, interlocks, and alarms were adequately described in the software description document (RPP-11159).

242-A Evaporator – At the 242-A Evaporator, the D/3 control module provided monitoring and control functions. The software consisted of databases and programs, including proprietary software for managing alarms, interlock logic, and analog and digital signals. The functional requirements were documented in HNF-3395. The software development plan (WHC-SD-534-SDP-001) called for the development a software requirements and specifications document. That document (SD-534-CSRS-001) generally described how the proprietary software development tools would be used to design and implement the software, but it did not provide the software requirements specifically. However, as is the case for other similar software applications, there was adequate requirements description in various software design documentation (e.g., WHC-SD-534-CSWD-006).

Conclusion:

The assessment criteria were fully satisfied. The functional and performance

requirements for the I&C software were complete, correct, consistent, clear, testable, and feasible. Also, software requirements were documented and consistent with the system safety basis (except as discussed below). SRDs were controlled and maintained. Requirements were identified and defined such that they could be verified and validated.

When the Tank Farms DSA was approved, there was no mechanism for a prompt reconciliation of new requirements with the existing MPSS and M&CS requirements. Instead, CH2M HILL anticipated that the unreviewed safety question process at project turnover would assure that all DSA requirements were satisfied. However, the assessment team was concerned that this approach could provide very late identification of inconsistencies resulting in project delays.

Except for MPSS and MCS, all software applications reviewed had a distinct SRD that included a well-defined functional requirements basis at the system level. Considering the nature of the applications involving PLC's and HMI, where the software requirements, design, and implementation life-cycle phases can often be integrated, the SRD along with the SDD provided adequate requirements description. In the case of the MPSS and MCS, the assessors found that the PDS and the SDD generally satisfied the need for software requirements definition and description. However, they also believed that the development of an appropriate software requirements specifications document (e.g., by applying a consensus standard such as IEC-880 or IEEE-830) would have provided greater traceability between system functional requirements and software design implementation, and thereby a greater assurance of reliability.

Issues:

- CH2M Hill should consider providing a formal administrative mechanism that links the MCS project development specification document to the authorization basis requirements.
- CH2M Hill should require its subcontractors to ensure that software requirements specifications are always specified and documented prior to commencing software design and implementation.

Key Personnel Interviewed:

R. R. Bevins, CH2M HILL project lead
M. G. Al-Wazani, CH2M Hill
R. L. Schlosser, CH2M Hill Engineering
C. V. Phillips, CH2M Hill, Startup and Testing
R. J. Stevens, CH2M Hill, Director of Nuclear Safety and Licensing
T. G. Goetz, CH2M Hill, Waste Feed Operations Nuclear Safety and Licensing
T. L. Warnick, Fluor Government Group Engineering
D.A. Lauhala, Fluor Government Group Engineering
J. W. Viita, Fluor Government Group, project manager
C. T. Narquis, Fluor Government Group Quality Assurance
W. D. Winkelman, CH2M Hill Waste Feed Operations Engineering
C. W. Jorgensen, CH2M Hill Waste Feed Operations Engineering

Submitted By: Aliyaz, Helt Approved By: [Signature]
Date: 8/31/04 Date: 8/31/04

Assessment Note

Assessment Note Number: A-04-ESQ-TANKFARM-011-02

Assessor Names(s): Shiv Seth

Dates of Assessment: August 2 – 9, 2004

Area/Item(s) Assessed: Software Design Description (SDD)

Objective: The SDD depicting the major components of the software design is defined and documented.

Criteria:

1. All I&C software-related requirements are implemented in the design.
2. All design elements are traceable to the requirements.
3. The design is correct, consistent, clearly presented, and feasible.

Documents Reviewed:

- HNF-6780, Rev. 1, dated September 2003 – *Project Development Specification for Monitoring and Control System, Project W-314*
- RPP-6921, Rev. 1, dated June 2003 – *Project W-314, Master Pump Shutdown System (MPSS) Software Design Document*
- RPP-6819, Rev. 1, dated January 2003 – *Requirements Verification Report for MPSS*
- RPP-7011, dated October 2000 – *Gap Analysis of MPSS Design Requirements to Subsystem Specifications*
- RPP-12520, dated December 2003 – *Master Pump Shutdown System Acceptance Test Report*
- W-314-I-168, dated March 2003 – *Instrumentation Alarm Set Point Accuracy Calculation*
- W-314-I-187, dated November 2003 – *Tank Farms Restoration and Systems Operations MCS I/O List*
- HNF-6779, dated 2003 – *Project Development Specification for HVAC*
- RPP-12722, dated February 2003 – *Software Requirements Specification for HVAC*
- RPP-10291, dated February 2003 – *Software Design Plan for HVAC*
- RPP-12716, Rev. 0, dated February 2003 – *Software Verification and Validation Plan for HVAC*
- RPP-10668, dated September 2002 – *System Design Description for AY/AZ Tank Farm Primary Ventilation System and Associated Cooling Water Systems*
- WHC-SD-WM-CSRS-025, dated April 1995 – *Computer Software Requirements and Specs for the AY/AZ Tank Farm Micon Automation System*
- WHC-SD-WM-SDP-010, dated April 1995 – *Software Development Plan for the AY/AZ Tank Farm Micon Automation System*

- HNF-SD-WM-CSWD-071, Rev. 3a, dated October 1998 – *Computer Software Configuration Description, 241-AZ & 241-AZ Tank Farm Micon Automation System*
- RPP-15126, Rev. 1, dated October 2003 – *System Design Description for SY Tank Farm Primary Ventilation System (DSA-Based)*
- RPP-11159, Rev. 0, dated June 2002 – *Computer Software Description for 241-SY B Train Exhauster*
- HNF-3395, Rev. 2, dated May 2003 – *Interface Control Document Between the 242-A Evaporator Facility and the Liquid Effluent Retention Facility*
- WHC-SD-534-SDP-001, Rev. 0, undated – *Process Control Computer Software Development Plan*
- WHC-SD-534-CSRS-001, Rev. 1, dated September 1993 – *Process Control Computer Software Requirements and Specifications*
- WHC-SD-534-CSWD-006, Rev. 2, dated April 1996 – *Continuous Control Databases for the 242-A MCS*
- WHC-SD-534-CSWD-005, Rev. 3, dated May 1996 – *Control System Device Logic Software Documentation*

Discussion:

The assessment team found that the software design descriptions for PLC and HMI applications in the various CH2M Hill projects reviewed in this assessment were sufficiently documented, but in different ways and under different document titles. The types of documents and the level of detail were strongly influenced by the software development approaches, COTS tools, and manuals provided by the different vendors. For example, if design implementation corresponded closely to functional requirements, and the developer relied heavily on vendor's manual descriptions, one document—called either requirements or design description—was prepared to integrate the needed software lifecycle documentation. The key document describing software design for each system (along with the functional title in parenthesis) is identified below:

- MPSS: RPP-6921 (software design document)
- AN Ventilation: RPP-12722 (software requirements description)
- AY/AZ Ventilation: HNF-SD-WM-CSWD-071 (software configuration description)
- SY-B Train Exhauster: RPP-11159 (software description)
- 242-A Evaporator: WHC-SD-534-CSWD-006, -005 (database, device logic software)

Because of the dependence of software design descriptions on the different, proprietary PLC-based I&C systems, the design documentation was generally difficult to follow without the necessary vendor training. However, the assessors were able to ascertain the following:

- The sampled system level functions (e.g., alarm functions) flowed down into the design document.
- Software components, conventions and choices made during development, interlocks, and alarms were listed or described.

- There was sufficient information (e.g., flow diagrams, input/output maps, logic, ladder listing, memory map, etc.), which would allow trouble shooting or software changes to be made by a trained and knowledgeable I&C software engineer.

The assessors interviewed system engineers who served as design authorities for the I&C systems, and found them to be well trained and knowledgeable about their systems. The design authority for the Micon application for AY/AZ ventilation system explained to the assessors the difficulty of making system modifications because of the complexity and lack of modularity in the system. This system however was soon to be replaced.

Additional pertinent details on the adequacy of software designs as they relate to implementing system functional requirements are provided in the assessment note on SRD.

Conclusion:

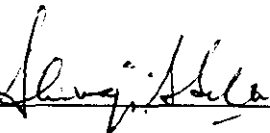

The software applications had generally adequate design descriptions consistent with the nature of PLC and HMI applications. The CRAD assessment criteria were met. I&C software-related requirements are implemented in designs, and design elements were traceable to the requirements. Designs were correct, consistent, clearly presented, and feasible.

Issues:

None.

Key Personnel Interviewed:

R. R. Bevins, CH2M HILL project lead
 R. J. Stevens, CH2M Hill, Director of Nuclear Safety and Licensing
 T. L. Warnick, Fluor Government Group Engineering
 D.A. Lauhala, Fluor Government Group Engineering
 J. W. Viita, Fluor Government Group, project manager
 C. T. Narquis, Fluor Government Group Quality Assurance
 W. D. Winkelman, CH2M Hill Waste Feed Operations Engineering
 C. W. Jorgensen, CH2M Hill Waste Feed Operations Engineering

Submitted By:  Approved By: 
 Date: 8/31/04 Date: 7/31/04

Assessment Notes

Assessment Note Number: A-04-ESQ-TANKFARM-011-03

Assessor Names(s): Clifford Ashley, Shiv Seth

Dates of Assessment: August 2-6, 2004

Area/Item(s) Assessed: Verification and Validation (V&V)

Objective:

The software V&V process and related documentation for I&C software are defined and maintained to ensure that (a) the software adequately and correctly performs all intended functions, and (b) the software does not perform any unintended function.

Criteria:

1. All I&C software requirements and software designs have been verified and validated for correct operation using testing, observation, or inspection techniques.
2. Relevant abnormal conditions have been evaluated for mitigating unintended functions through testing, observation, or inspection techniques.

Discussion:

The assessors reviewed documentation and interviewed key personnel responsible for the software identified below. This was done to determine if software requirements and software design had been verified and validated for correct operation using testing, observation, or inspection techniques. Software applications included in the assessment were:

- Master Pump Shutdown System logic and development tools
- AN Tank Farm Primary Tank Ventilation
- SY B-Train Exhauster System
- AY/AZ Tank Farm Ventilation System
- 242-A Process Control System

The assessors reviewed the following documents:

- Master Pump Shutdown System (MPSS) Software Change Requests (SCR) 587, 678, 668, 706 through 740, and 828.
- RPP-7827, Rev. 1, Project 314, *Demonstration Test Plan for Master Pump Shutdown System*, dated September 27, 2001.
- RPP- 7828, Rev. 0, Project W-314, *Test Design Specification for Master Pump Shutdown System*, dated September 27, 2001.

- RPP-9614, Rev. 0, *Project W-314 Tank Farm Restoration & Safe Operations Phase 1 Master Pump Shutdown System Upgrades*, dated September 24, 2002.
- RPP-12520, Rev. 1, *Master Pump Shutdown (MPSS) System Acceptance Test Report*, dated December 11, 2003.
- RPP-12716, Rev. 0, *Software Verification and Validation Plan for HVAC, Project 314*, dated November 2002.
- RPP-14903, Rev. 0, *Qualification Test Report for AN Farm HVAC System, Project 314*, May 2003
- RPP-17672, Rev. 1, *241-AN Exhauster Train A Acceptance Test Report, Project 314*, dated July 28, 2004.
- RPP-19375, Rev. 1, *Tank Farm Restoration & Safe Operations Phase II Upgrades, Project W314, 244-S DCRT Bypass Acceptance Test Report*, dated May 13, 2004.
- OAC-W314244S-01, Rev. 1, *Operational Acceptance Checklist, 244-S DCRT Bypass System*, dated, June 8, 2004.
- SY B-Train Exhauster Work Package # 2W-02-013338/W
- WHC-SD-534-CSWD-006, Rev. 2, *242-A Evaporator Quality Assurance Requirements*, dated April 3, 1996.
- AY/AZ Primary Tank Ventilation Software Change Request/Problem Reports CR/PR# 35, 36, and 37.
- Fluor Government Group Surveillance QS-2004-009 and cover letter JRM-2004-013, dated May 25, 2004.
- Statement of Work (Requisition #96197), *Project W-314, M&CS Software Development*, Rev. 0, Dated January 2003
- RPP-21081 *Software Quality Assurance Plan for WFO Process Control Systems (PCS)*, dated April 2004.
- RPP-21082 *Software Configuration Management Plan for WFO Process Control Systems (PCS)*, dated April 2004.

The assessors evaluated a sample of V&V plans and test reports for quality-affecting software. CH2M HILL's own V&V documentation for AY/AZ primary tank ventilation was adequate except for some minor discrepancies. The Demonstration Test Plan (RPP-7827) and Test Design Specification (RPP-7828) generated by CH2M HILL for the master pump shutdown system (MPSS) were also adequately documented.

The key procedure governing maintenance of I&C software did not specify the correct process for testing changes to I&C software made during maintenance activities. CH2M HILL made procedure TFC-ENG-DESIGN-P-12, Rev. A, "Process Control Software Procedure" effective on April 2, 2004 to describe the overall process for developing, documenting, testing, control, and maintenance of I&C software. Despite a statement in the "Purpose and Scope" section of the procedure to include maintenance, there was no section specific to maintenance. However, the assessment team judged that procedure section 4.6, "Modification of Implemented Software," addressed most software maintenance activities. For testing of completed changes, this section required testing to be conducted in accordance with several testing procedures, including TFC-PRJ-SUT-C-01, "Test Plan Preparation," and TFC-ENG-DESIGN-C-18, "Testing Practices."

However, these procedures, along with the other procedures invoked by section 4.6, contained scope statements that explicitly excluded testing of maintenance work.

The assessment team reviewed CH2M HILL's software quality assurance plan (SQAP), and software configuration management plan (SCMP) for Waste Feed Operations (WFO) process control systems, and determined that these plans did not provide adequate criteria for determining significance of safety software changes that would consistently require the appropriate level of V&V testing and documentation. The WFO SCMP lacked criteria for initiating a software change request (SCR), although it discussed the SCR process in Section 3.1.10.

Conclusion:

The assessment criteria were partially satisfied. CH2M HILL and FGG were verifying software requirements and validating software designs for correct operation. They were also evaluating relevant abnormal conditions for mitigating unintended functions.

However, the assessment team found that CH2M HILL's new key procedure governing control of I&C software referenced invalid procedures for making and testing software changes. Also, the WFO SQAP, and the WFO SCMP lacked sufficient criteria to consistently test changes to I&C software.

ISSUES:

- CH2M HILL plans and procedures did not accurately define the processes for identification and execution of software maintenance and testing.

Key Personnel Contacted:

E. R. Hamm, CH2M HILL Engineering
R. R. Bevins, CH2M HILL project lead
C. V. Phillips, CH2M Hill, Startup and Testing
T. L. Warnick, Fluor Government Group Engineering
D.A. Lauhala, Fluor Government Group Engineering
J. W. Viita, Fluor Government Group, project manager
C. T. Narquis, Fluor Government Group Quality Assurance
W. D. Winkelman, CH2M Hill Waste Feed Operations Engineering
C. W. Jorgensen, CH2M Hill Waste Feed Operations Engineering

Submitted By: 

Approved By: 

Date: 8/31/04

Date: 8/31/04

Assessment Notes

Assessment Note Number: A-04-ESQ-TANKFARM-011-04

Assessor Names(s): David Brown

Dates of Assessment: August 2 - 6, 2004

Area/Items(s) Assessed: Software User Documentation

Objective and Criteria – CRAD-4.2.3.1, Rev. 3, Section 4.4:

Software documentation is available to guide the user in installing, operating, managing, and maintaining I&C software.

1. The system requirements and constraints, installation procedures, and maintenance procedures such as database fine-tuning are clearly and accurately documented.
2. Any operational data system requirements and limitations are clearly and accurately documented.
3. Documentation exists to aid the users in the correct operation of the software and to provide assistance for error conditions.
4. Appropriate software design and coding documentation to assist in any future software modifications is defined and documented.

The assessors reviewed documentation for the software identified below to assess compliance with requirements governing the installation and use of the software and to determine whether documentation was available to guide the user in installing, operating, managing, and maintaining the software. Software included in this assessment area:

- The Tank Farms monitoring and control system (M&CS); includes the master pump shutdown system (MPSS)
- The Micon monitoring and control equipment in the AY/AZ ventilation system
- The AN Farm primary ventilation monitoring and control equipment
- The 242-A Evaporator monitoring and control equipment

Observations and Assessments

The assessors visited the offices of FGG where software was developed and maintained for the Tank Farms M&CS, the AY/AZ ventilation system control room, and the 242-A Evaporator control room. The assessors evaluated user's manuals, guides, and related documents for a sample of the software at these locations. Documents reviewed included:

CH2M HILL QA Program

- TFC-PLN-02, Rev. A-3, dated November 19, 2003 – *Quality Assurance Program Description*

Software User Documentation

- RPP 18966, Rev. 0, *Operation and Maintenance Manual for the Monitoring and Control System*
- Tranec, Inc., document 96675.3, Rev. 0, *Operation and Maintenance Manual* (used on the A 1000CFM portable exhauster)
- Allen-Bradley Publication IC-942, March 1993, *SLC 500 Thermocouple/mV Input Module*
- Allen-Bradley Publication IC-942, March 1993, *Remote I/O Scanner*
- Allen-Bradley Publication 2706-816, *MessageView 421 Display Terminal*
- Micon User's Manual, 1995, *A/S View*
- Micon User's Manual, Rev. C, 1991, *Micon-View 2.4, Sparc-Based Micon-View System Basic User's Guide*
- Micon User's Manual, *U-32R Controller User's Manual*
- D/3 User's Manual, 1993, Version 6, *Work Station User's Guide*
- D/3 User's Manual, 1993, Version 6, *Operation Console User's Guide*
- Digital Equipment Corporation User's Manual, *VMS version 5.0*, April 1988

User Documentation

The assessors reviewed the documents listed above to determine whether they contained sufficient documentation of system requirements and constraints, installation procedures, operational requirements and limitations, and user training requirements.

With the exception of the user's manual for the M&CS system, user documentation was all supplied by vendors with their equipment. User's manuals contained appropriate documentation for their equipment. Documentation provided information to aid the users in the correct operation of the software and to provide assistance for error conditions. Manuals reviewed by the assessors appeared to provide adequate guidance on software design and coding requirements.

However, manuals also reflected the age of the equipment. For example, the equipment supplied by Micon-Powell Process Systems, Inc., for the AY/AZ ventilation system was last revised in the early 1990s. Some equipment in the 242-A evaporator was from the 1980s.

The M&CS user's manual provided appropriate procedures and information for maintaining the firmware and logic in the system. It was directed at a relatively high level, addressing the needs of programmers and technicians working directly with the firmware and logic.

At the 242-A Evaporator, the user's manuals on the shelf for the D/3 equipment were for release 6.3, but release 9 was installed in the system. The CH2M HILL system engineer stated that release 9 documentation was supplied on compact discs (CDs), but CH2M

HILL had not printed it out and placed the current documentation on the shelf. (The 242-A Evaporator was the responsibility of Fluor Hanford, Inc., until May 26, 2003.)

Training

Personnel responsible for maintaining equipment usually received training from vendors. For example, the system engineer responsible for the D/3 system in the 242-A Evaporator attended vendor-supplied training from Novatech Process Systems. FGG personnel attended vendor-provided training for using the Citect software in the development of software for the MPSS. However, no formal training was available for the Micon monitoring and control system of the AY/AZ ventilation system.

Personnel responsible for maintaining Allen-Bradley equipment also had not received any formal training on developing and maintaining Allen-Bradley ladder logic. Safety functions for the SY B-Train ventilation and filter differential pressure (d/p) interlocks in several farms were controlled by Allen-Bradley programmable logic controllers (PLCs). CH2M HILL also used Allen-Bradley PLCs in a number of non-safety applications, such as leak detection for low-level waste transfer lines. The Waste Feed Operations (WFO) Engineering organization had only one individual responsible for maintaining this software, and he said he had learned the Allen-Bradley language and processes from the user's manuals. When software changes were made, WFO obtained technical reviews from subcontractors or other CH2M HILL software engineers outside the WFO Engineering organization.

Conclusion:

The criteria were met. User's manuals contained appropriate documentation for their equipment. Documentation provided information to aid the users in the correct operation of the software and to provide assistance for error conditions. Manuals reviewed by the assessors appeared to provide adequate guidance on software design and coding requirements and processes.

The control room user's manuals for the D/3 equipment in the 242-A Evaporator were not current. The current documentation was on a CD kept by the system engineer. The assessment team considers CH2M HILL should print out the user documentation and use it to replace the outdated documents in the Evaporator control room.



While CH2M HILL has provided appropriate training on most equipment, it had not provided training for personnel maintaining Allen-Bradley PLCs. Also, the cadre of personnel with the training and skill to maintain any PLCs was very small. The assessment team concluded CH2M HILL should provide additional training and train additional personnel in developing and maintaining software for PLCs.

Issues:

- The D/3 documentation in the 242-A Evaporator should be replaced with documentation applicable to the release installed in the evaporator.
- Engineering should provide additional training and train additional personnel for developing and maintaining software for programmable logic controllers.

Key Personnel Contacted:

W. D. Winkelman, CH2M HILL Engineering
E. R. Hamm, CH2M HILL Engineering
R. R. Bevins, CH2M HILL M&CS Project
C. W. Jorgensen, CH2M HILL Engineering

Submitted By:  Approved By: 
Date: 8/3/04 Date: 8/3/04

Assessment Notes

Assessment Note Number: A-04-ESQ-TANKFARM-011-05

Assessor Names(s): Clifford Ashley, Shiv Seth

Dates of Assessment: August 2-6, 2004

Area/Item(s) Assessed: Software Configuration Management (SCM)

Objective: The software components and products are identified and managed, and changes to those items are controlled.

Criteria:

1. All software components and products to be managed are identified.
2. For those components and products, procedures exist to manage the modification and installation of new versions.
3. Procedures for modifications to those components and products are followed.

Observations and Assessments:

Discussion:

The assessors reviewed documentation and interviewed key personnel responsible for the software identified below. This was done to determine if software requirements and software design had software components and products identified and managed, and changes to those items are controlled. Software applications included in the assessment were:

- Master Pump Shutdown System logic and development tools
- AN Tank Farm Primary Tank Ventilation
- SY B-Train Exhauster System
- AY/AZ Tank Farm Ventilation System
- 242-A Process Control System

The assessors reviewed the following documents:

- Master Pump Shutdown System (MPSS) Software Change Requests (SCR) 587, 678, 668, 706 through 740, and 828.
- RPP-7827, Rev. 1, Project 314, *Demonstration Test Plan for Master Pump Shutdown System*, dated September 27, 2001.
- RPP- 7828, Rev. 0, Project W-314, *Test Design Specification for Master Pump Shutdown System*, dated September 27, 2001.
- RPP-9614, Rev. 0, Project W-314 *Tank Farm Restoration & Safe Operations Phase 1 Master Pump Shutdown System Upgrades*, dated September 24, 2002.

- RPP-12520, Rev. 1, *Master Pump Shutdown (MPSS) System Acceptance Test Report*, dated December 11, 2003.
- SY B-Train Exhauster Work Package # 2W-02-013338/W
- Evaporator SCR
- AY/AZ Primary Tank Ventilation Software Change Request/Problem Report CR/PR# 35, 36, and 37.
- Fluor Government Group Surveillance QS-2004-009 and cover letter JRM-2004-013, dated May 25, 2004.
- Statement of Work (Requisition #96197), *Project W-314, M&CS Software Development*, Rev. 0, Dated January 2003
- RPP-21081 *Software Quality Assurance Plan for WFO Process Control Systems (PCS)*, dated April 2004.
- RPP-21082 *Software Configuration Management Plan for WFO Process Control Systems (PCS)*, dated April 2004.
- PER-2004-0296, dated January, 2004
- CH-04-RPP-QSR-022 Observation No. 2 (PER-2004-0763), dated January 2004
- TFC-OPS-OPER-C-11, Rev. A-1, dated February 2004 – *Equipment Temporary Modifications and Bypasses*
- TFC-PRJ-SUT-C-01, Rev. B-2, dated June 2004 – *Test Plan Preparations*
- TFC-PRJ-SUT-C-02, Rev. B, dated August 2004 – *Operational Acceptance Test Preparation*
- TFC-PRJ-SUT-C-03, Rev. A-1, dated November 2003 – *Conduct of Testing*

The assessors evaluated a sample of software procedures, plans and reports for quality-affecting software as it relates to the criteria outlined above. In most cases CH2M HILL maintained adequate configuration control of software components and products.

Software change requests were not adequately maintained, as evidenced by the following examples. It should be noted that the majority of the issues identified were associated with the MPSS, and where the MPSS Qualification Test Report (RPP-9614) stated that “open SCR’s would be handled by the MPSS SQAP release process,” however this process was neither timely nor fully effective.

- CH2M HILL could not find the most recent SCR for the SY B-Train Exhauster.
- Sixteen SCR’s for the MPSS (SCR # 711, 714, 716, 722, 723, 726, and 731 through 740) that were initiated prior to August 2002 (during the MPSS qualification testing), and were not closed until after January 2004. The closure of these SCR’s occurred well after the acceptance test was completed and report (RPP 12520) issued. After the assessment team reviewed these SCR’s, it was apparent that the majority of the SCR’s were sufficiently complex that they could have adversely affected the acceptance testing if they were not effectively closed prior to this testing.
- Ten SCRs initiated by FGG for the MPSS (SCRs # 715, 717 through 720, 724, and 727 through 730) were documented as being “closed” without any “closed

by” signature or date in the SCR status record, or on the “MPSS System and Software Change Request and Problem Report Form” documents.

- Sixteen SCRs initiated by FGG for the MPSS (SCR # 678, 707, 708, 711, 714, 717 through 720, 722 through 724, 726, 732, 737, and 740) were documented as being “closed” without any “verified by” signature or date in the FGG SCR status record, or on the “MPSS System and Software Change Request and Problem Report Form” documents.
- Ten SCRs initiated by FGG for the MPSS (SCR #587, 668, 678, 706 through 712) were documented as being “closed” on the FGG SCR status record, but did not have the “verified by” and/or “closed by” signature and date information that appeared on the on the original hard copy “MPSS System and Software Change Request and Problem Report Form.”
- One SCR initiated by FGG for the MPSS (#710) that was documented as being “closed” on FGG’s SCR status record, had “closed by” signature and date information that was significantly different then the original hard copy “MPSS System and software change Request and Problem Report Form.”
- One SCR initiated by FGG for the MPSS (#730) that was documented as being “closed” on FGG’s SCR status record had a “verified by” signature and date (September 25, 2002) that did not appear on the original hard copy “MPSS System and Software Change Request and Problem Report Form.”
- One MPSS qualification test requirement (3.2.1.4.3.6.1.6) was appropriately deferred until acceptance testing could be performed, however an SCR written over a year ago was still open.

The assessment team reviewed CH2M Hill’s experience with controlling temporary modifications made to software (often termed as “software forces”) for operational acceptance testing. Specifically, CH2M Hill had issued surveillance CH-04-RPP-QSR-022 as well as two problem evaluation requests (PERs) documenting problems with the control of software forces. The problems occurred on the C-200 waste retrieval project. The first (PER-2004-0296) identified that certain software forces were not reflected in the approved software version for testing, while the second (PER-2004-0763) observing that specific instructions for installation and removal of software forces were not included in the operational acceptance test procedure for the project. The personnel interviewed by the assessment team, as well as the written response to the PERs, concluded that “a software force is just one example of a temporary modification,” and as such did not need to be explicitly included in the controlling test procedures.

The assessment team reviewed the suite of CH2M Hill procedures on planning, preparation, and conduct of testing, as well as the procedure especially developed for defining and controlling temporary modifications (TFC-OPS-OPER-C-11). The latter procedure provided an extensive list of 18 detailed examples of temporary modifications and bypasses, but did not include software forces. Cognizant CH2M HILL personnel said the list was intended to constitute examples and not be exhaustive. However, the

assessors believed that the list was such that it could be mistakenly taken by CH2M Hill staff to serve as complete a complete list of temporary modifications and bypasses. They came to the conclusion that software forces, especially because they are less tractable than hardware modifications, should be explicitly recognized and included in these procedures.

Conclusion:

The CRAD assessment criteria were partially satisfied. The assessment team found that CH2M Hill had adequately identified their software components and products, and procedures existed to manage the modification and installation of new versions. However the assessors also found that software change request documentation and temporary modifications to I&C software were not always completed in accordance to plans or procedures.

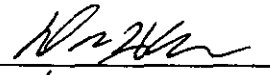
Issues:

- Software change request documentation was not adequately maintained.
- Temporary modifications to I&C software ("software forces") were not fully addressed in CH2M HILL procedures.

Key Personnel Contacted:

R. R. Bevins, CH2M HILL project lead
R. J. Stevens, CH2M Hill, Director of Nuclear Safety and Licensing
T. L. Warnick, Fluor Government Group Engineering
D.A. Lauhala, Fluor Government Group Engineering
J. W. Viita, Fluor Government Group, project manager
C. T. Narquis, Fluor Government Group Quality Assurance
W. D. Winkelman, CH2M Hill Waste Feed Operations Engineering
C. W. Jorgensen, CH2M Hill Waste Feed Operations Engineering

Submitted By: 

Approved By: 

Date: 8/31/04

Date: 8/31/04

Assessment Notes

Assessment Note Number: A-04-ESQ-TANKFARM-011-06

Assessor Names(s): David Brown

Dates of Assessment: August 2-6, 2004

Area/Items(s) Assessed: Software Quality Assurance

Objective and Criteria – CRAD-4.2.3.1, Rev. 3, Section 4.6:

SQA activities are evaluated for applicability to the analysis and design software, defined to the appropriate level of rigor, and implemented.

1. SQA activities and software practices for requirements management, software design, software configuration management, procurement controls, V&V (including reviews and testing), and documentation have been evaluated and established at the appropriate level for proper applicability to the I&C software under assessment.
2. SQA activities have been effectively implemented.

The assessors reviewed documentation and interviewed key personnel responsible for the software identified below in order to assess the software quality assurance (SQA) processes used by CH2M HILL and its subcontractors. Software applications and databases included in the assessment:

- Master Pump Shutdown System logic and development tools
- AN Tank Farm Primary Tank Ventilation
- SY B-Train Exhauster System
- AY/AZ Tank Farm Ventilation System
- 242-A Process Control System

Observations and Assessments:

The assessors reviewed:

- The CH2M HILL Quality Assurance Program Description (QAPD),
- CH2M HILL and Fluor Government Group (FGG) procedures and standards that govern process system software quality assurance,
- Assessment reports prepared by CH2M HILL and FGG to document its most recent assessments of their software quality processes,
- The quality assurance plans prepared for a specific software applications,
- Problem Evaluation Requests (PERs) related to software quality assurance, and
- CH2M HILL and FGG software change requests.

The assessors reviewed or referred to the following documents:

QA Program Description

- TFC-PLN-02, Rev. A-3, dated November 19, 2003 – *Quality Assurance Program Description*

Procedures and Standards

- TFC-ENG-DESIGN-P-12, Rev. A, *Process Control Software Procedure*
- TFC-ENG-STD-24, Rev. A, *Process Control Software Standard*

Audits, Assessments, and Associated Documents

- Fluor Federal Services memorandum CO-04-RPP-415, J. W. Viita to C. T. Narquis, "Surveillance Report QS-2004-009 Related Item: Adverse Condition Report ACR-2004-0005," dated June 16, 2004
- Fluor Federal Services Surveillance Report QS-2004-009, *M&CS Software Development*, dated May 25, 2004
- CH2M HILL Quality Surveillance Report CH-04-RPP-QSR-022, Rev. 0, *C-200 Waste Retrieval Monitoring and Control System Software*, dated January 23, 2004
- CH2M HILL Quality Surveillance Report CH-04-RPP-QSR-183, Rev. 0, *C-200 Software*, dated December 4, 2003
- CH2M HILL Quality Surveillance Report CH-04-RPP-QSR-164, Rev. 0, *S-112 Monitoring and Control System Software Quality Assurance*, dated October 21, 2003
- CH2M HILL Quality Surveillance Report CH-04-RPP-QSR-034, Rev. 0, *Software Control for PLCs*, dated March 4, 2003
- CH2M HILL Quality Surveillance Report CH-04-RPP-QSR-0028, Rev. 0, *AY & AZ Phase 2, FFS*, dated February 26, 2003

SQA Plans

- RPP-21081, Rev. 0, *Software Quality Assurance Plan for WFO Process Control Systems*
- RPP-14515, Rev. 0, *Software Quality Assurance Plan for SY Farm Primary Tank Ventilation System B-Train Exhauster Skid*
- RPP-6764, Rev. 0, *Software Quality Assurance Plan for Monitoring and Control System (Tank Farms Restoration and Safe Operations – Fluor Federal Services)*
- RPP-6764, Rev. 1, *Software Quality Assurance Plan for Monitoring and Control System (Tank Farms Restoration and Safe Operations – Fluor Federal Services)*
- RPP-6764, Rev. 2 [Draft], *Software Quality Assurance Plan for Monitoring and Control System (Tank Farms Restoration and Safe Operations – Fluor Federal Services)*

Problem Evaluation Requests

- PER-2003-4938
- PER-2003-4939
- PER-2004-0296

Other Documents

- RPP-8792 Rev. 7, *Subsystem and Component Level Safety Equipment List for Tank Farms Safety Systems*
- Statement of Work; Requisition 96187, *W314 Start-Up and Turnover, MPSS/M&CS*, Revision 0
- ORP letter 02-TED-015, Roy J. Schepens to E. S. Aromi, CH2M HILL, *Report of Master Pump Shutdown System Technical Acceptability Review*, dated December 3, 2002
- ORP assessment A-02-AMSQ-TANKFARM-004, *Phase II Vital Safety System Assessment, AN Tank Farm Primary Ventilation System*

Observations and assessments for specific areas of interest are discussed below.

SQA Program and Procedures:

CH2M HILL Plans and Procedures – ORP evaluated the CH2M HILL software quality assurance program and procedures during assessment A-04-ESQ-TANKFARM-006, April 19-26, 2004. However, at the time of the current assessment, CH2M HILL had added two directives, TFC-ENG-DESIGN-P-12, *Process Control Software Procedure*, and TFC-ENG-STD-24, Rev A, *Process Control Software Standard*. The assessment team evaluated both directives and found they had generally appropriate content. However, as discussed below, TFC-ENG-DESIGN-P-12, “Process Control Software Procedure” did not correctly address testing of I&C software following maintenance. The new procedures reflected a continuing effort by CH2M HILL to upgrade its SQA processes following DNFSB Tech-25.

TFC-ENG-DESIGN-P-12 did not specify the correct process for testing changes to I&C software made during maintenance activities. CH2M HILL made procedure TFC-ENG-DESIGN-P-12 effective on April 2, 2004 to describe the overall process for developing, documenting, testing, control, and maintenance of I&C software. Despite a statement in the “Purpose and Scope” section of the procedure to include maintenance, there was no section specific to maintenance. However, the assessment team judged that procedure section 4.6, “Modification of Implemented Software,” addressed most software maintenance activities. For testing of completed changes, this section required testing to be conducted in accordance with several testing procedures, including TFC-PRJ-SUT-C-01, “Test Plan Preparation,” and TFC-ENG-DESIGN-C-18, “Testing Practices.” However, these procedures, along with the other procedures invoked by section 4.6, contained scope statements that explicitly excluded testing of maintenance work.

While there were SQA plans for different projects and activities, CH2M HILL was consolidating its Waste Feed Operations process control SQA plans into a single document. This was RPP-21081, *Software Quality Assurance Plan for WFO Process Control Systems*, dated April 2004. CH2M HILL managers stated that all I&C safety software was under the cognizance of the Waste Feed Operations organization, therefore, all safety I&C software would eventually be addressed by RPP-21081. The assessment team reviewed this document and found that it appropriately addressed the important

features of SQA. (The V&V assessment note discusses an issue with the level of rigor in WFO SQA plan.) At the time of the fieldwork, RPP-21081 addressed the AY/AZ ventilation system, the 242A evaporator process control system, and the high efficiency particulate air filter differential pressure interlocks at several tank farms. New systems, such as for the SY Farm primary tank ventilation system B-Train skid, would be added by changing the document to add new appendices.

Master Pump Shutdown System – CH2M HILL contracted Fluor Government Group (FGG) to design and install the master pump shutdown system (MPSS). This entailed a relatively extensive software design, development, and deployment project. Following the issuance of DNFSB Tech-25, *Quality Assurance for Safety-Related Software at Department of Energy Defense Nuclear Facilities*, CH2M HILL made a contract requirement for FGG to assure that problems identified in the DNFSB report would be precluded from occurring in the MPSS software. The assessment team concluded this was an effective step in assuring FGG would apply sound software engineering principles in development of MPSS software. Lessons learned from the DNFSB report were incorporated into the MPSS software quality assurance plan and software configuration management plan.

The two most recent contract statements of work required FGG to follow the CH2M HILL software engineering procedures, however FGG personnel said they followed the project software quality assurance plan and the software configuration management plan. The assessment team reviewed the two plans and found they described appropriate software engineering processes in considerable detail. While the assessment team expected FGG would follow procedures based on the plans (rather than the plans themselves), the plans were sufficiently detailed that the small software development organization could follow them as procedures.

SY Farm B-Train Exhauster Skid – CH2M HILL specified SQA requirements for the SY Farm exhauster software in RPP-14515, *Software Quality Assurance Plan for SY Farm Primary Tank Ventilation System B-Train Exhauster Skid*. CH2M HILL issued this document in March 2003, although the system had been in service since the mid 1990s. Therefore, the plan did not address software development, only maintenance and retirement. The assessment team evaluated the plan and found that, taken together with CH2M HILL's software engineering procedures, it had appropriate scope and content. The plan was representative of CH2M HILL's efforts to improve software quality assurance following DNFSB Tech-25.

Assessment

CH2M HILL Assessments – ORP evaluated the CH2M HILL software audits and assessments during assessment A-04-ESQ-TANKFARM-006, April 19-26, 2004. The assessment identified weaknesses in the depth and breadth (but not frequency) of CH2M HILL software assessments. At the time of the fieldwork for the current assessment, CH2M HILL had implemented corrective action by transferring responsibility for software assessments to a new assessment organization. ORP accepted the corrective

action, but sufficient time had not passed to allow ORP to assess the effectiveness of the corrective action.

The assessment team reviewed five CH2M HILL surveillances of I&C software development and maintenance. They ranged in depth from observing a design review meeting (CH-03-RPP-QSR-0028) to a technically credible review of documentation for the S-112 monitoring and control system software quality assurance (CH-03-RPP-QSR-164).

FGG Assessments – For the MPSS, FGG had performed some surveillances intended to confirm MPSS software was conforming to contract requirements. These were process assessments that verified the presence of required documents and quality assurance program features. In the view of the assessment team, the assessments would have been more valuable if they had greater technical depth.

One FGG surveillance, QS-2004-009, indicated a need for increasing the technical depth of software surveillances. The assessment team reviewed the assessment report, interviewed the individual who performed the surveillance assessment, and interviewed the responsible engineering personnel. It found that the surveillance addressed straightforward compliance issues, but the assessment team doubted it could have identified more complex and threatening breakdowns.

Conclusion:

The CRAD criteria were generally met. CH2M HILL had significantly improved its SQA processes since DNFSB Tech-25 was issued. Some continuing issues were documented by ORP in A-04-ESQ-TANKFARM-006, *Control of Tank Farms Contractor Design and Analysis Computer Software*, but CH2M HILL and FGG were resolving these.

CH2M HILL had recently issued a new I&C software engineering procedure and a new I&C software standard. The assessment team found both generally included appropriate guidance and direction. However, the new procedure did not correctly identify procedures for testing software changes made during maintenance. CH2M HILL Waste Feed Engineering had also issued a new SQA plan intended to address I&C safety software. CH2M HILL was in the process of extending its scope to address safety systems, but each system needed to be addressed individually.

In assessment report A-04-ESQ-TANKFARM-006, ORP identified deficiencies in the CH2M HILL assessment program with respect to SQA. At the time of the current assessment, ORP and CH2M HILL had not finished closing this issue.

FGG engineers were not explicitly following CH2M HILL software engineering procedures for MPSS system and M&CS system development work as specified in the contract between CH2M HILL and FGG. Instead, FGG personnel were following

relatively detailed requirements in the MPSS SQA and configuration management plans. The SQA and configuration management plans, as well as the CH2M HILL procedures, described appropriate software engineering processes, but they were not the same. Therefore, while FGG was not complying with its contractual obligations to CH2M HILL, the assessment team did not identify any resulting problems with the software FGG was developing.

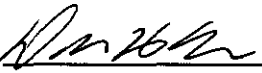

While FGG performed independent surveillance assessments of MPSS and M&CS software development activities, these lacked technical depth. While surveillances could identify compliance issues, they lacked the technical depth to identify more complex process breakdowns. For example, the answers to questions on a surveillance checklist reflected a superficial understanding on the part of the surveillance engineer of the relative roles of different software components.

Issues:

- In implementing quality assurance requirements, FGG should provide specific software engineering procedures.
- The technical depth of FGG assessments of software development activities should be improved.

Key Personnel Contacted:

E. R. Hamm, CH2M HILL Engineering
J. S. Davis, CH2M HILL Nuclear Safety Program
C. Maciuca, CH2M HILL Quality Assurance
J. W. Viita, FGG M&CS Project
D. A. Lauhala, FGG Engineering
T. L. Warnick, FGG Engineering
J. R. McCallum, FGG Quality Assurance
C. T. Narquis, FGG Quality Assurance

Submitted By:  Approved By: 
Date: 8/31/04 Date: 8/31/04

Assessment Notes

Assessment Note Number: A-04-ESQ-TANKFARM-011-07

Assessor Names(s): David Brown

Dates of Assessment: August 2 - 6, 2004

Area/Items(s) Assessed: Software Procurements

Objective and Criteria – CRAD-4.2.3.1, Rev. 3, Section 4.7:

Acquired software meets the applicable level of quality to ensure the safe operation of the system.

1. Agreements for acquiring software programs or components identify the quality requirements appropriate for their use.
2. Acquired software is verified to meet the identified quality requirements.

The assessors reviewed documentation and interviewed key personnel responsible for the software identified below to assess the quality assurance processes CH2M HILL used in procuring products and services related to or affected by software. Software and firmware included in the assessment:

- Master Pump Shutdown System Logic and Development Tools
- AN Tank Farm Primary Tank Ventilation
- SY B-Train Exhauster System
- AY/AZ Tank Farm Ventilation System
- 242-A Process Control System

The software evaluated by the assessment team was primarily operating system firmware located in programmable logic controllers (PLC) and other purchased instrument and control equipment.

Observations and Assessments:

The assessors reviewed or referred to the following documents:

QA Program Description

- TFC-PLN-02, Rev. A-3, dated November 19, 2003 – *Quality Assurance Program Description*

Procedures and Standards

- TFC-BSM-CP_CPR-C-05, Rev. C-3, dated February 12, 2004 – “Procurement of Services”

- TFC-BSM-CP_CPR-C-06, Rev. C, dated December 18, 2003 – “Procurement of Items (Materials)”

Other Documents

- ORP letter 02-TED-015, Roy J. Schepens to E. S. Aromi, CH2M HILL, *Report of Master Pump Shutdown System Technical Acceptability Review*, dated December 3, 2002
- ORP assessment A-02-AMSQ-TANKFARM-004, *Phase II Vital Safety System Assessment, AN Tank Farm Primary Ventilation System*
- Excelsior Design, Inc., purchase order 00195, dated February 6, 2003; RTL programmable logic controller, firmware, and associated components
- RTP Corp. Nuclear Class 1E Certificate of Conformance for RTP Corp. sales order No. 45707; including programmable logic controller and associated firmware

Observations and assessments for specific areas of interest are discussed below.

ORP evaluated the software procurement processes of CH2M HILL and FGG in assessment A-04-ESQ-TANKFARM-006. Issues identified in that assessment were still being resolved at the time of this current assessment and were not further pursued by this assessment team.

M&CS and Master Pump Shutdown System – DOE-ORP evaluated supplier evaluations for the MPSS software during a technical evaluation in November 2002. This was documented in ORP letter 02-TED-015, Roy J. Schepens to E. S. Aromi, CH2M HILL, “Report of Master Pump Shutdown System Technical Acceptability Review,” dated December 3, 2002. The ORP assessment found that FGG had appropriately evaluated suppliers and procured software for the MPSS system. The assessment team determined that the results of the technical evaluation were still valid because the safety software used on the project was still governed by these procurements.

SY B-Train Exhauster – The assessment team evaluated the procurement of a programmable logic controller and its associated software for the SY B-train ventilation equipment. This equipment was procured in the 1997-1998 timeframe, and CH2M HILL did not have the documentation of the procurement specifying implementation of technical requirements in the purchase. Specifically, the purchase requisition was lost. However, this issue was previously identified and resolved as part of the corrective action plan for DNFSB Recommendation 2000-2 vital safety system assessments. Procurement weaknesses were addressed in correspondence associated with ORP assessment A-02-AMSQ-TANKFARM-004, *Phase II Vital Safety System Assessment, AN Tank Farm Primary Ventilation System*.

AN Farm Ventilation – The assessment team evaluated the procurement of two programmable logic controllers for the AN Tank Farm ventilation system grades as safety significant. This included a review of certificates of conformance provided by the manufacturer. The manufacturer was RTL Corporation, who supplies 1E grade

programmable logic controllers to the nuclear industry. The assessment team did not find any problems with the procurements.

AY/AZ Ventilation – Both the hardware and software for the AY/AZ ventilation system monitoring and control system were procured by a previous contractor before contractors were effectively implementing now-familiar software procurement requirements. Also, at the time of this current assessment, the vendor, Micon-Powell Process Systems, Inc., was no longer capable of fully supporting all of its customers. Therefore, CH2M HILL had decided to replace the whole AY/AZ ventilation monitoring and control system during the upcoming budget cycle. The assessment team considered this was an appropriate approach for resolving this situation.

242-A Evaporator – The portion of the software for the 242-A Evaporator involving a safety function was procured before current software procurement expectations were established. The system has functioned properly for years, so the assessment team does not consider that there are any quality assurance issues with it. Also, the new M&CS system will take over the Evaporator monitoring and control system safety function in the coming months. The M&CS system is expected to meet all specified quality assurance requirements and standards.

Conclusion:

The criteria were met for current procurements. While CH2M HILL did not have objective evidence that some procurements made in the mid-1990s conformed to all requirements, this problem was identified and resolved previously.

Issues:

None.

Key Personnel Contacted:

E. R. Hamm, CH2M HILL Engineering
W. D. Winkelman, CH2M HILL Engineering

Submitted By: Wm Hamm Approved By: Wm Hamm
Date: 8/31/04 Date: 8/31/04

Assessment Notes

Assessment Note Number: A-04-ESQ-TANKFARM-011-08

Assessor Names(s): David Brown

Dates of Assessment: August 2 - 6, 2004

Area/Items(s) Assessed: Software Problem Reporting and Corrective Action

Objective and Criteria – CRAD-4.2.3.1, Rev. 3, Section 4.8:

A process for I&C software problem reporting is established, maintained, and controlled; including notification of errors, failures, and corrective action development.

1. Documented practices and procedures for reporting, tracking, and resolving problems or issues are defined and implemented.
2. Organizational responsibilities for reporting issues, approving changes, and implementing corrective actions are identified and found to be effective.

The assessors reviewed documentation and interviewed key personnel responsible for the software identified below to assess the processes used by CH2M HILL and its subcontractors for software problem reporting and corrective action. Software applications included in the assessment were:

- Master Pump Shutdown System logic and development tools
- AN Tank Farm Primary Tank Ventilation
- SY B-Train Exhauster System
- AY/AZ Tank Farm Ventilation System
- 242-A Process Control System

Observations and Assessments:

The assessors visited the offices and field locations where CH2M HILL and subcontractor personnel developed and maintained the software and evaluated procedures, user's manuals, guides, and related documents for a sample of the software. They also interviewed CH2M HILL and Fluor Government Group (FGG) personnel. The assessors reviewed or referred to the following documents:

CH2M HILL QA Program

- TFC-PLN-02, Rev. A-3, dated November 19, 2003 – *Quality Assurance Program Description*

CH2M HILL Procedures, Standards, and Project Process Documents

- TFC-ENG-DESIGN-P-12, Rev. A, *Process Control Software Procedure*

- RPP-21081, Rev. 0, *Software Quality Assurance Plan for WFO Process Control Systems*
- RPP-21082, Rev. 0, *Software Configuration Management Plan for WFO Process Control Systems*
- RPP-6764, Rev. 0, *Software Quality Assurance Plan for Monitoring and Control System*
- RPP-6764, Rev. 1, *Software Quality Assurance Plan for Monitoring and Control System*
- RPP-6764, Rev. 2 (draft), *Software Quality Assurance Plan for Monitoring and Control System*

Error Notices

- Master Pump Shutdown System (MPSS) software change request 908, March 9, 2004, *Valve Status for W-211 MOVs into MCS for AW Farm*
- Master Pump Shutdown System software change request 909, March 9, 2004, *Valve Status for W-211 MOVs into MCS for AZ Farm*
- Master Pump Shutdown System software change request 910, March 11, 2004, *X-Site Pumps Fail to Verify*
- Master Pump Shutdown System software change request 917, March 15, 2004, *Check Route Parameters*
- 242-A Evaporator MCS Change Request/Problem Report MCS-04-005, Alarm Colors and TSR-Related Leak Detection Signals
- Monitoring and Control System (M&CS) software change request 899, March 4, 2004, *A-242 Node: Weird MPS Relay Verification Results*
- Monitoring and Control System software change request 903, March 5, 2004, *AY-AZ Farm: Verification Could Generate Weird Results*

ORP evaluated the CH2M HILL software quality assurance program and procedures during assessment A-04-ESQ-TANKFARM-006, April 19-26, 2004. That assessment identified weaknesses in the error reporting processes in CH2M HILL procedures. In response, CH2M HILL agreed to improve their procedures by specifying the error reporting and resolution processes from NQA-1, subpart 2.7 in CH2M HILL procedures. As of the fieldwork for the current assessment, the corrective action commitment date had not passed, and CH2M HILL had not completed that corrective action. The assessment team did not see a need to investigate this issue further until CH2M HILL completed and validated its corrective actions.

Because the software error reporting process was not described in either FGG or CH2M HILL company-wide procedures, the assessment team noted a number of error reporting and resolution processes. These were formalized in configuration management plans and other documents, therefore the processes met CH2M HILL's contract obligations to ORP. However, the assessment team viewed the multiplicity of processes as awkward. Responsible CH2M HILL personnel told the assessment team that a more uniform approach to error reporting and resolution was being developed in response to the earlier ORP assessment finding, although some decisions on how to structure the system had not been made.

In the case of software errors encountered during the development and testing of MPSS software, the project quality assurance plan specified an error reporting process. The process included a specific form to document identification and resolution of software errors. The assessment team reviewed a sample of error reporting forms and identified a few anomalies. These are discussed in the configuration management section of this report.

RPP-21081, *Software Quality Assurance Plan for WFO Process Control Systems*, specified that software errors should be addressed through the Problem Evaluation Request (PER) process. However, RPP-21082, *Software Configuration Management Plan for WFO Process Control Systems* also provided a "software change request" process that included a form for problem reporting. At the time of the assessment, these two plans applied to AY/AZ ventilation system, the 242-A Evaporator D/3 PCS system, and the programmable logic controllers for air filters in several tank ventilation systems. Cognizant CH2M HILL personnel said they intended to eventually extend the scope of these two plans to cover all Waste Feed Operations digital monitoring and control equipment.

Conclusion:

While the criteria for problem reporting and corrective action were met, multiple processes existed for different software development and maintenance activities. CH2M HILL said they were in the process of establishing a single, company-wide procedure for software error reporting.

Software errors were reported and resolved using the established systems, both in CH2M HILL and FGG. Problems with discipline in error reporting and resolution are addressed in the configuration management section of this report.

Issues:

None

Key Personnel Contacted:

E. R. Hamm, CH2M HILL Engineering
W. D. Winkelman, CH2M HILL Engineering
T. L. Warnick, FGG M&CS Project
D. A. Lauhala, FGG M&CS Project
J. W. Viita, FGG M&CS Project

Submitted By: *[Signature]*

Approved By: *[Signature]*

Date: 8/31/04

Date: 8/31/04

E-STARS™ Report
Task Detail Report
09/13/2004 0824

TASK INFORMATION			
Task#	ORP-ESQ-2004-0081		
Subject	CONCUR:04-ESQ-074; REQUEST FOR ACTION ON ASSESSMENT OF INSTRUMENT AND CONTROL (I&C) COMPUTER SOFTWARE		
Parent Task#		Status	CLOSED
Reference	04-ESQ-074	Due	
Originator	Gano, Becky	Priority	High
Originator Phone	(509) 376-6004	Category	None
Origination Date	09/01/2004 1552	Generic1	
Remote Task#		Generic2	
Deliverable	None	Generic3	
Class	None	View Permissions	Normal
Instructions	<p>Correspondence is being routed for concurrence via hard copy instead of electronically. Once you receive the correspondence, please approve or disapprove electronically via E-STARS and route to next person on the routing/concurrence list.</p> <p>BCC: ESQ OFF FILE ESQ RDG FILE MGR RDG FILE R.C.BARR, ESQ D.H.BROWN, ESQ P.P.CARIER, ESQ J.S.O'CONNOR, OPA</p> <p>RECORD NOTE: CLOSES CARS 6848, SUBTASK 6.</p>		
ROUTING LISTS			
1	Route List		Inactive
	• Brown, David H - Review - Concur - 09/02/2004 0705		
	• Carier, Patrick P - Review - Concur - 09/02/2004 1331		
	• Barr, Robert C - Review - Concur - 09/09/2004 1534		
	• Swailes, John H - Review - Concur - 09/10/2004 1213		
	• Schepens, Roy J - Approve - Approved with comments - 09/10/2004 1236		
ATTACHMENTS			
Attachments	<ol style="list-style-type: none">04-ESQ-074 Assessment Note SDD SS081604 (Dave).doc04-ESQ-074 Assessment Note SRD SS081704 (Dave).doc04-ESQ-074 att Assessment Report A-04-TANKFARM-011.doc04-ESQ-074 CH2M LTR REQUEST FOR ACTION ON ASSESSMENT OF I&C COMPUTER SOFTWARE.doc04-ESQ-074 CRAD 4 4 - Software User Documentation.doc04-ESQ-074 CRAD 4 6 - Software Quality Assurance.doc04-ESQ-074 CRAD 4 7 - Software Procurements.doc04-ESQ-074 ORP Management Walkthrough Completion Form Att 9-8.doc04-ESQ-074 SCM Assessment Note (Final).doc04-ESQ-074 VV Assessment Note (Final).doc		
COMMENTS			

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SEP 13 2004

DOE-ORP/ORPCC

Poster	Schepens, Roy J (Brazil, Kelly) - 09/10/2004 1209
	Approve
	Rob Barr signed for Roy 9/9/04
TASK DUE DATE HISTORY	
<i>No Due Date History</i>	
SUB TASK HISTORY	
<i>No Subtasks</i>	

-- end of report --

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E-STARS™ Report
Task Detail Report
09/09/2004 0336

TASK INFORMATION			
Task#	ORP-ESQ-2004-0081		
Subject	CONCUR:04-ESQ-074; REQUEST FOR ACTION ON ASSESSMENT OF INSTRUMENT AND CONTROL (I&C) COMPUTER SOFTWARE		
Parent Task#		Status	Open
Reference	04-ESQ-074	Due	
Originator	Gano, Becky	Priority	High
Originator Phone	(509) 376-6004	Category	None
Origination Date	09/01/2004 1552	Generic1	
Remote Task#		Generic2	
Deliverable	None	Generic3	
Class	None	View Permissions	Normal
Instructions	<p>Correspondence is being routed for concurrence via hard copy instead of electronically. Once you receive the correspondence, please approve or disapprove electronically via E-STARS and route to next person on the routing/concurrence list.</p> <p>BCC: ESQ OFF FILE ESQ RDG FILE MGR RDG FILE R.C.BARR, ESQ D.H.BROWN, ESQ P.P.CARIER, ESQ J.S.O'CONNOR, OPA</p> <p>RECORD NOTE: CLOSES CARS 6848, SUBTASK 6.</p>		
ROUTING LISTS			
1	Route List		Active
	<ul style="list-style-type: none"> Brown, David H - Review - Concur - 09/02/2004 0705 Carier, Patrick P - Review - Concur - 09/02/2004 1331 Barr, Robert C - Review - Concur - 09/09/2004 1534 Swailles, John H - Review - Awaiting Response Schepens, Roy J - Approve - Awaiting Response 		
ATTACHMENTS			
Attachments	<ol style="list-style-type: none"> 04-ESQ-074 Assessment Note SDD SS081604 (Dave).doc 04-ESQ-074 Assessment Note SRD SS081704 (Dave).doc 04-ESQ-074 att Assessment Report A-04-TANKFARM-011.doc 04-ESQ-074 CH2M LTR REQUEST FOR ACTION ON ASSESSMENT OF I&C COMPUTER SOFTWARE.doc 04-ESQ-074 CRAD 4 4 - Software User Documentation.doc 04-ESQ-074 CRAD 4 6 - Software Quality Assurance.doc 04-ESQ-074 CRAD 4 7 - Software Procurements.doc 04-ESQ-074 ORP Management Walkthrough Completion Form Att 9-8.doc 04-ESQ-074 SCM Assessment Note (Final).doc 04-ESQ-074 VV Assessment Note (Final).doc 		
COMMENTS			

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DOE-ORP/ORPCC

E-STARSM Report
Task Detail Report
09/01/2004 0402

TASK INFORMATION			
Task#	ORP-ESQ-2004-0081		
Subject	CONCUR:04-ESQ-074; REQUEST FOR ACTION ON ASSESSMENT OF INSTRUMENT AND CONTROL (I&C) COMPUTER SOFTWARE		
Parent Task#		Status	Open
Reference	04-ESQ-074	Due	
Originator	Gano, Becky	Priority	High
Originator Phone	(509) 376-6004	Category	None
Origination Date	09/01/2004 1552	Generic1	
Remote Task#		Generic2	
Deliverable	None	Generic3	
Class	None	View Permissions	Normal
Instructions	<p>Correspondence is being routed for concurrence via hard copy instead of electronically. Once you receive the correspondence, please approve or disapprove electronically via E-STARS and route to next person on the routing/concurrence list.</p> <p>BCC: ESQ OFF FILE ESQ RDG FILE MGR RDG FILE R.C.BARR, ESQ D.H.BROWN, ESQ P.P.CARIER, ESQ J.S.O'CONNOR, OPA</p> <p>RECORD NOTE: CLOSES CARS 6848, SUBTASK 6.</p>		
ROUTING LISTS			
1	Route List		Active
<p>103 9/2</p> <ul style="list-style-type: none"> ● Brown, David H - Review - Awaiting Response ● Carier, Patrick P - Review - Awaiting Response <i>MC 9/2/04</i> ● Barr, Robert C - Review - Awaiting Response <i>RUB 9/9/04</i> 			
ATTACHMENTS			
Attachments	<ol style="list-style-type: none"> 04-ESQ-074 att Assessment Report A-04-TANKFARM-011.doc 04-ESQ-074 CH2M LTR REQUEST FOR ACTION ON ASSESSMENT OF I&C COMPUTER SOFTWARE.doc 		
COMMENTS			
No Comments			
TASK DUE DATE HISTORY			
No Due Date History			
SUB TASK HISTORY			
No Subtasks			

-- end of report --

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